VOL. XV, NO. 1

JULY, 1950

THE TOOL ENGINEER

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Departments

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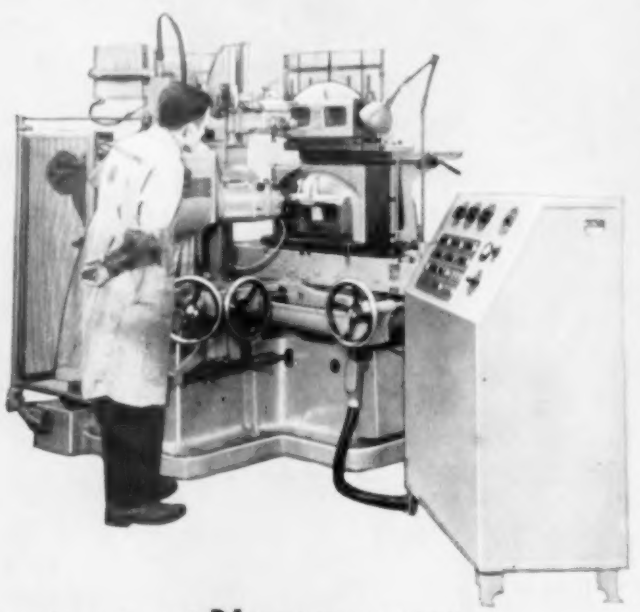

THE 24" x 16" ***BL*** KELLER MACHINE

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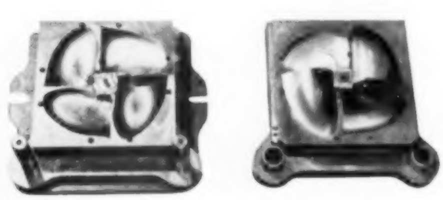

A set of fan blade dies machined on the ***BL*** KELLER, typical of the precision work produced at new speeds — new profits.

LOOK into it — the new ***BL*** KELLER (24" x 16" and 36" x 20") gives you a competitive advantage you cannot afford to overlook when it comes to the accurate duplication of templates and models by automatic, tracer-controlled milling in the production of dies, molds, patterns, prototypes, short-run parts — 2 dimensional and 3 dimensional. Its new speed substantially reduces actual machine hours, a performance factor of tremendous profit potential. Bulletin gives all the facts; ask for it.

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The Tool Engineer

Official Publication: American Society of Tool Engineers

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JULY, 1950

Vol. XXV No. 1

Editorial

The Man Behind the National Wealth

THAT THE ABILITY of the United States to produce is the basis of our national wealth, rather than the mere existence of manufactured products, is an interesting point made by J. Handley Wright, speaking before a recent meeting of a national society of public relations counselors.

"Is it products, as such—bathtubs, automobiles, hairpins—that make up our standard of living? Or is it production . . . the process by which these things not only come into being but which provides the purchasing power to put them into the hands of the consumer?

"Production is the first, the vital step which must be taken before we have products. Production is the working energy of men and women, putting tools into their hands, and then applying this energy. . . ."

This view was certainly proved during the last war, when the basis of our military victory rested on the ability of American industry to convert almost overnight to a mammoth program of armament which soon completely outweighed our enemies.

And the basis of our ability to produce in such quantities rests on the engineering genius behind the machine. This genius is responsible for the technical developments, and the application of these developments, which leave the United States with a production potential still unused even in the present period of high productivity.

In other words, it is tool engineering which is responsible for the production machine which is industrial America. And it is the tool engineer who can properly take the credit for transforming ideas or designs into practicalities which mean higher production at less cost, and therefore a higher standard of living for all.

H. L. Tigges

President 1950-51

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MASS PRODUCTION

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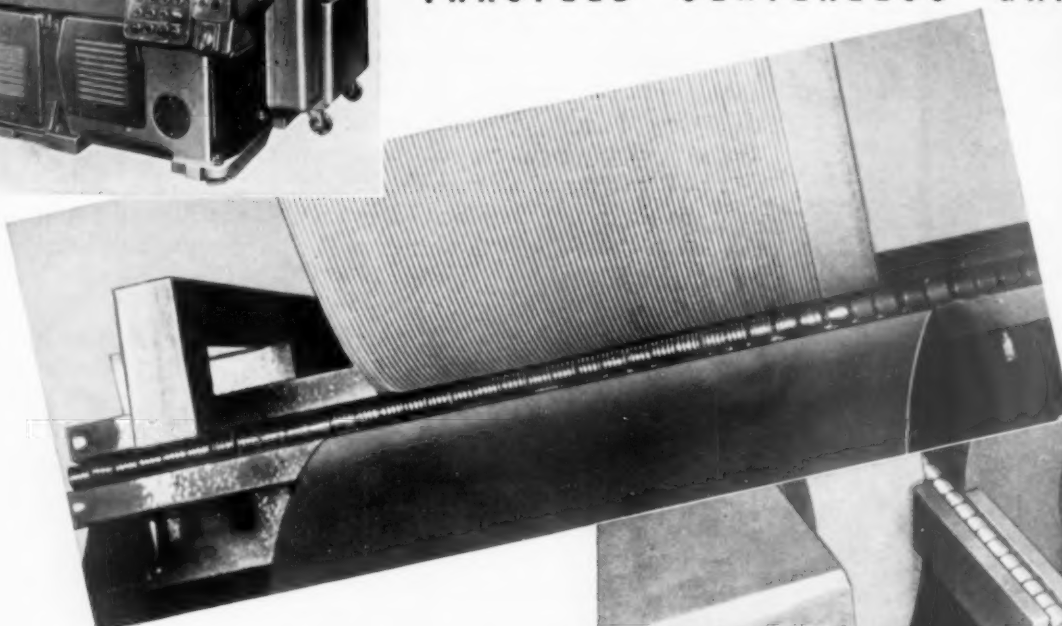
5,700 SET SCREWS EVERY HOUR BY THRUFEED CENTERLESS GRINDING



• Completely automatic—the #1 Centerless Thread Grinder threads 1/4" by 5/16" 20 pitch hollow head set screws to standard tolerances at 5,700 pieces per hour. Blanks are fed continuously into the machine by a simple hopper—finished parts are ejected into trays ready for removal. Only partial supervisory attention is needed. Grinding wheel crushings are infrequent—the machine operates on an average of 40 continuous production hours—200,000 pieces—between wheel crushings.

Any workpiece requiring threads on the maximum diameter only and without interfering shoulders which would prevent passage through the grinding throat can be centerless ground by the thrufeed method. Headed or shouldered pieces must be ground by the infeed process. Diametrical capacity is 1/16" to 4-3/4", thrufeed or plunge cut. *Write for Bulletin E-97.*

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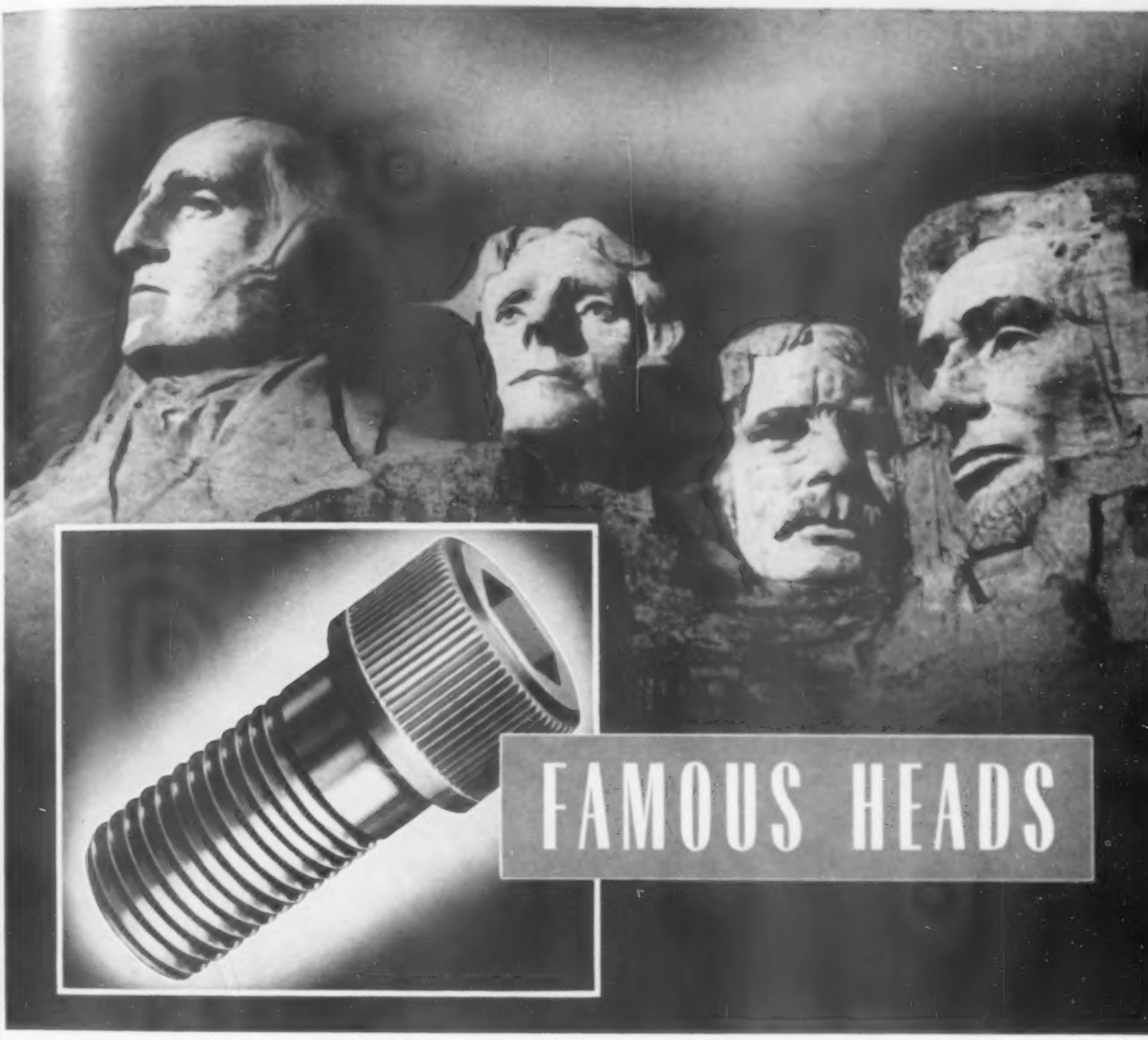
THREADING MACHINERY—THREAD CUTTING DIE HEADS—COLLAPSIBLE TAPS



The *knurling* on the head of the UNBRAKO Socket Head Cap Screw saves valuable assembly time because the UNBRAKO can be screwed in faster and further with the fingers—the handiest of all wrenches—before an actual wrench is needed. The slip-proof knurling "gears" the screw to the fingers, even when they are oily or greasy . . . which is especially important in the smaller sizes.

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★ INDICATOR furnished with either .0001″ or .001″ graduations.

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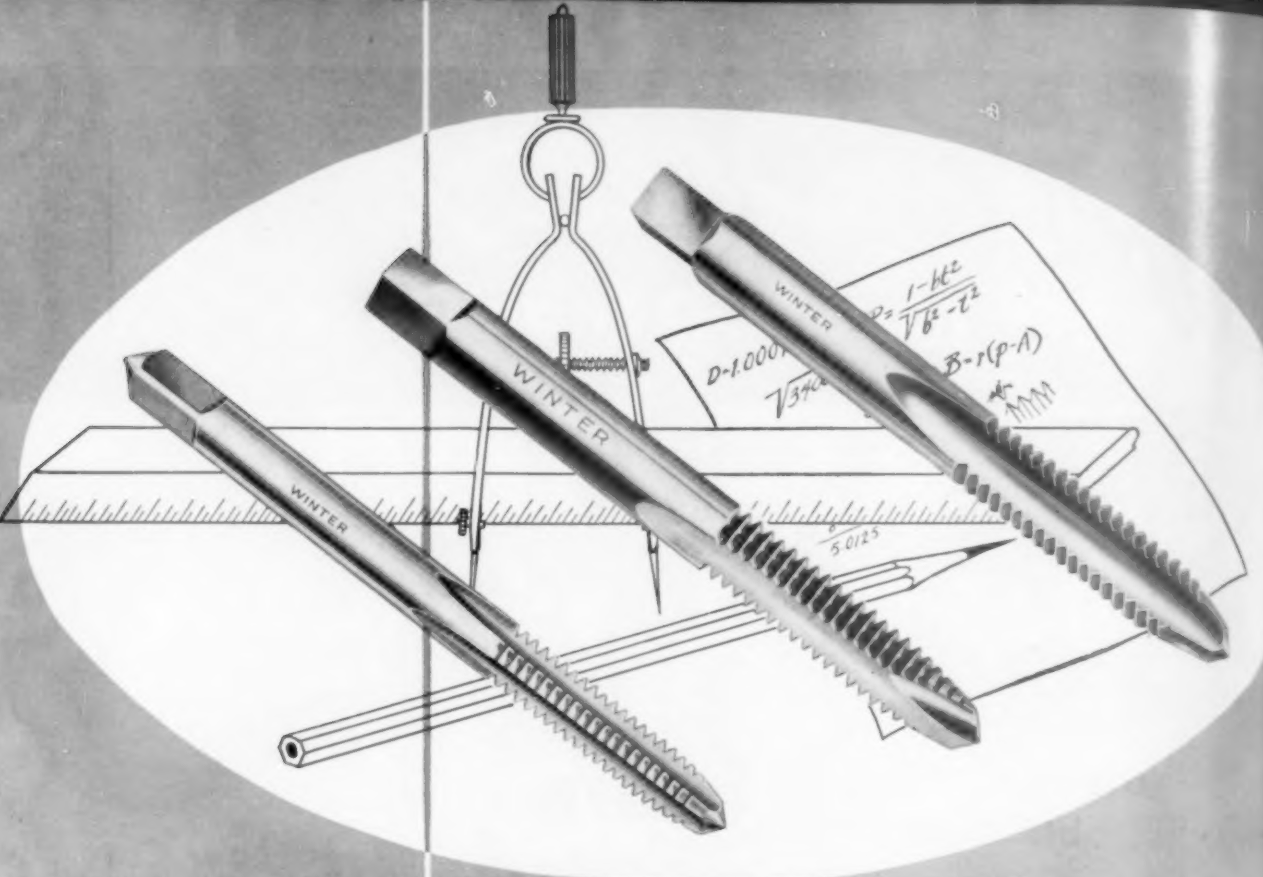

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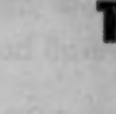

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YOUR LOCAL DISTRIBUTOR carries a complete stock of WINTER Taps on his shelves—as close to your tapping problems as the telephone on your desk.

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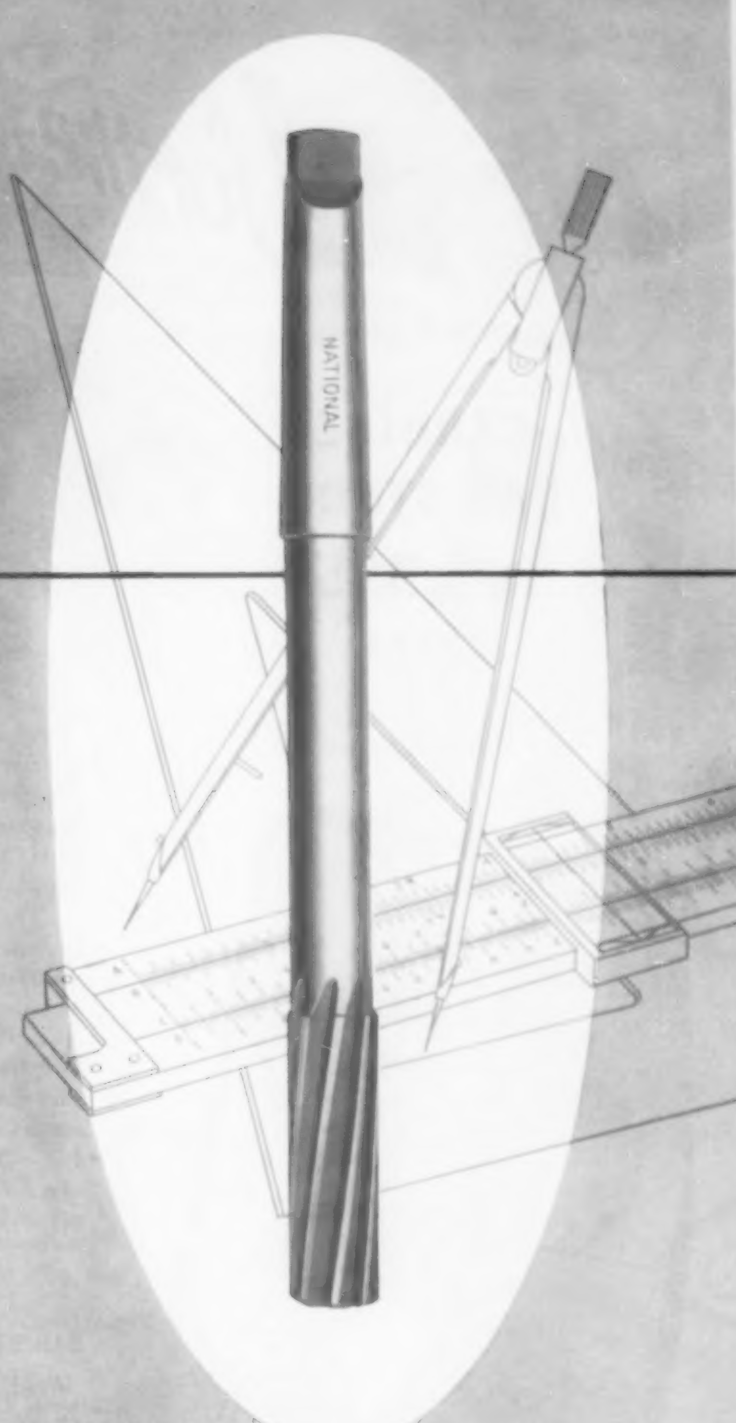

Reaming consists of enlarging, smoothing, and bringing to exact size a previously made hole. To satisfactorily perform this important function a reamer must be properly designed, accurately sized and made, and have good wearing qualities.

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[⅓ actual size; Selector is in 3 colors]

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"Handiest selector I've ever seen"

"No more gambling on tool steel selection"

"You're right, the application should dictate the choice of the tool steel" **. . .** and many, many more favorable comments.

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Write for your Selector today! We want you to have it, because we know you've never seen anything that approaches your tool steel problems so simply and logically. Just fill out the coupon and mail. Act now! CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, N. Y.

Here's how it works:

To use the Selector, all you need know is the characteristics that come with the job: type and condition of material to be worked, the number of pieces to be produced, the method of working, and the condition of the equipment to be used.

FOUR STEPS—and you've got the right answer!

1. Move arrow to major class covering application
2. Select sub-group which best fits application
3. Note major tool characteristics (under arrow) and other characteristics in cut-outs for each grade in sub-group
4. Select tool steel indicated

That's all there is to it!

Here's an example:

Application—Deep drawing die for steel

Major Class—Metal Forming—Cold

Sub-Group — Special Purpose

Tool Characteristics — Wear Resistance

Tool Steel—Airdi 150

One turn of the dial does it!

And you're sure you're right!!

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Sure! I want my CRUCIBLE TOOL STEEL SELECTOR!

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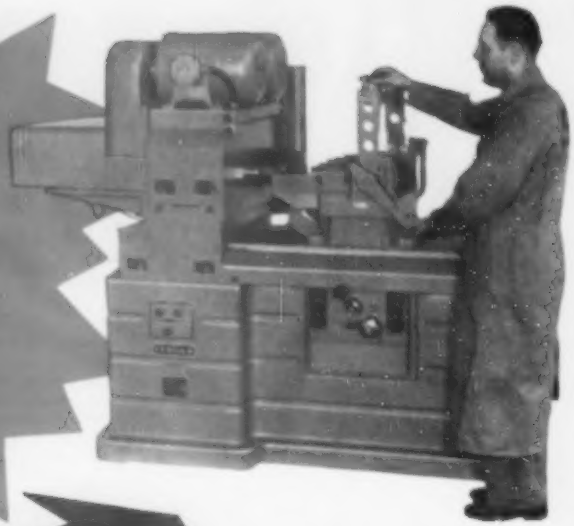
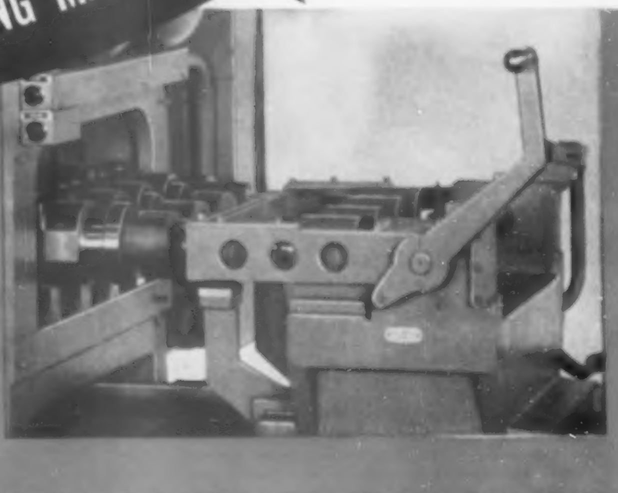
8 SURFACES MACHINED ...1046 PIECES PER HOUR ...

... ON EX-CELL-O PRECISION BORING MACHINE



Operator placing pistons on loadi
pins. Movement of the loading lev
controls the automatic machine cyc



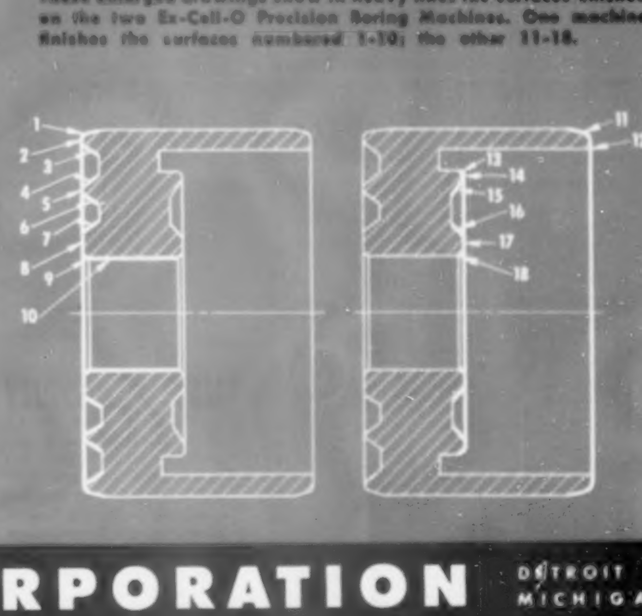
Here the loading bracket has been turned down toward the spindles. Further movement of the loading lever seats parts in the chucks.

Two Style 112-C Ex-Cell-O Precision Boring Machines finish eighteen surfaces of the parts shown in the drawings at right below. One machine finishes 8 surfaces at the net rate of 1046 pieces per hour; the companion machine finishes 10 surfaces at the net rate of 640 pieces per hour. The parts are automotive shock absorber pistons, approximately one inch in diameter.

The spindles, four on each machine, operate continuously. Work loading equipment and automatic ejection of finished parts contribute to the extremely fast machine cycles.

Whether your work involves precision machining in large volume or in small lots you'll find that it's economical to use *standard machines* whenever possible. Ask your Ex-Cell-O representative for complete information on standard Ex-Cell-O Precision Boring Machines.

These enlarged drawings show in heavy lines the surfaces finished on the two Ex-Cell-O Precision Boring Machines. One machine finishes the surfaces numbered 1-10; the other 11-18.



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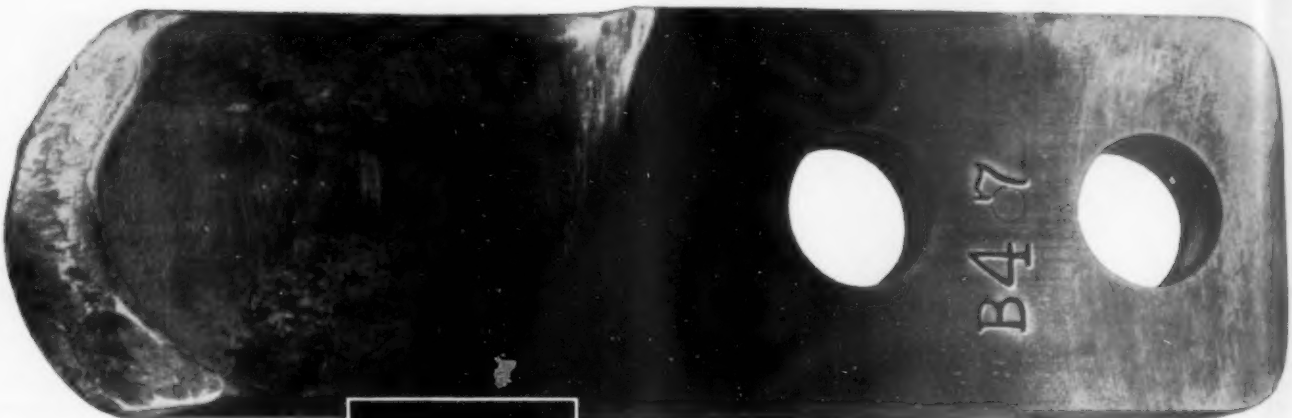

This punch gave double service!

This block had double life!

This die lasted 50% longer!

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...anywhere from ***1½*** *to* ***5*** *times the Performance!*

SOME TYPICAL EXAMPLES

B-47 dummy blocks, vs. 9% and 12% tungsten types, extruded more than twice as many brass and copper tubes. B-47 dies outperformed 12% tungsten type 1½ to 1.

B-47 punches, vs. low-carbon 18-4-1 type, hot pierced more than twice as many eyes in steel axes. See top picture.

B-47 die inserts, vs. 9% tungsten types, hot pressed more than twice as many steel side gear forgings. B-47 die inserts, vs. regular insert material, performed better than 5 to 1.

B-47 dummy blocks, vs. 5% tungsten-5% chromium types, extruded twice as many copper and brass tubes and rods. B-47 dies outperformed 12% tungsten-12% chromium type.

B-47 punches, vs. 5% chromium type, hot extrusion forged 1½ times as many automotive steel front axle spindles.

B-47 die inserts, vs. 9% tungsten types, extruded 1½ times as many high alloy steel automotive valves. This is considered a very difficult job for any grade of hot work steel.

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for "Blue Sheet" on Grade B-47

This four-page folder gives technical data on B-47 for brass extrusion dummy block and dies, valve extrusion die inserts, hot punch tools, forging die inserts, press forging dies, and hot work in general. *Write for your copy today.*

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Looking for a better hot work steel? You'll find it in B-47—an improved chromium, tungsten, cobalt, vanadium type whose superiority is established by actual performance runs such as those summarized above. All tests show that B-47 has unusual resistance to shock and abrasion at elevated temperatures.

Developed originally for applications in the copper and brass industry, B-47 has given excellent results on difficult hot work jobs on steel. B-47, when properly heat treated, exhibits a well rounded combination of red hardness, toughness, and resistance to wear and heat checking that makes it a valuable addition to the Allegheny Ludlum group of hot die steels.

Put B-47 to the test. You'll find that it will do any number of severe hot work jobs without washing out or changing size. Get in touch with A-L today. Let us help you to use B-47.

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The Mechanics of Clamping Devices

By Lawrence E. Doyle
ASSISTANT PROFESSOR OF MECHANICAL ENGINEERING
UNIVERSITY OF ILLINOIS

A CLAMPING DEVICE MUST be properly proportioned for leverage, stability, and strength. It must be able to impose upon the workpiece an adequate force when acted upon by the minimum force that can be expected to be applied to it. Once applied, the clamp must be able to maintain its position until released; it must be self locking or irreversible. In addition to performing those functions, the clamp must have enough strength to resist excessive deflection and even failure from the forces and reactions bearing upon it. The extent to which any device possesses each of these features can be appraised from the simple principles of mechanics.

An experienced designer can usually proportion a clamp to do a job and stand up satisfactorily. Lacking that experience, one may find indicators of performance helpful in pointing the way to proper proportions. In either case, an understanding of the theory of clamping devices is an aid to judgment. The principles of mechanics governing the actions of clamps are well known. Quite often when they are presented in schools, their applications to clamping devices are not pointed out. For our course in tool engineering, an analysis of the general forms of clamping devices has been prepared based upon the fundamentals that engineering students are taught in basic courses. Such a study of the theory of clamps is presented in this series of articles.

All fasteners employ one or more variations of the simple means of securing mechanical advantage. These are the wedge and its more intricate aspects, the screw and cam, and the lever and its composite form, the toggle. The lever is commonly used in conjunction with at least one of the others because of its simplicity. All except the simple lever can easily be made self-locking or non-reversible. Each form has certain distinct features. They will be taken up in turn, but first several general considerations applicable to all should be discussed.

Clamping Forces

If the leverage of a clamp is to be determined, the force that can be applied to it and the force it is to deliver must be specified. The magnitudes of the expected forces must be determined before a mechanism can be proportioned for strength. Thus, the first consideration is that of how external forces and reactions may be estimated.

Clamps are normally used to hold workpieces during cutting operations. For that purpose, a clamp has two functions; to force the workpiece firmly against the locating surfaces and to hold it there against the cutting forces. Therefore, the cutting force in an operation is an index of the value of the clamping force required. Many investigations have been made to determine the sizes and directions of cutting forces. Reference is made in the bibliography at the end of this article to several sources of metal cutting data. (1), (2), (3), (4).

A cutting force is not necessarily directly opposed by a clamping force. In fact, it is usually preferable to direct cutting forces against fixed stops or locators, although often it is not possible to divert all components from the clamps. A common resort, as in a vise, is to apply a clamping force to set up a frictional resistance to a cutting force. Furthermore, it is not normally possible to predict exactly from tests what the forces may be in actual production operations. The status of the cutter, the feed, and the condition of the material cannot always be foretold. It is feasible, though, to estimate extreme or limiting conditions and take measures to counteract them. In other words, while it is not possible to say just what the forces are likely to be in a particular milling operation, it is possible to arrive at reasonable values which are not likely to be exceeded and to provide clamping forces large enough to take care of them. Thus, on the basis of the test data and an analysis of the interactions within a set-up, it is usually possible to determine what minimum forces a clamp must impose for security.

Manual Application of Clamping Forces

An idea of the least force an operator is likely to apply to a hand-operated clamp is important, so that enough leverage can be provided to step up his exertion to give the minimum force the clamp must impose. In addition, an

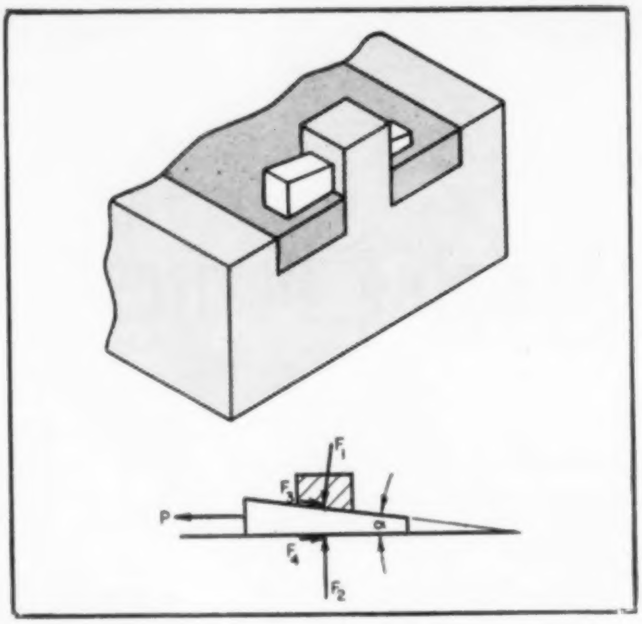

Fig. 1. Forces acting on a wedge at the instant removal of the wedge begins.

estimate of the largest exertion an operator may make is necessary. Suppose an operator applies a force of 30 pounds to a clamp handle, and the clamp in turn imposes a load of 500 pounds on the workpiece. Another operator comes along and applies 120 pounds to the handle. The clamp then imposes a force of 2000 pounds on the workpiece and in return receives a reaction of that amount. Obviously, it must have sufficient strength to withstand the largest likely reaction.

We know that human strength varies considerably. The distribution of human strengths, like many other physical phenomena, may be approximated by a normal curve. Most of the cases are clustered around an average or mean. Away from the average in both directions the number of cases becomes less and less. The results of several studies of human strength, are shown in Table I.

Human strengths, such as those reported in Table I, are usually measured on dynamometers. Four events, right and left hand grip, back lift and leg lift are considered proportional to total strength. Intercorrelations among various dynamometrical strength tests have been found to average about 0.90 (5). Thus, the variations experienced in the conventional tests are indicative of what may be expected in applications to a clamping device. For the results reported in Table I, the maxima and minima have been taken at the three sigma limits of the reported observations, within which practically all cases fall. The figures indicate that the greatest strength in most actions is normally three to four times the least. Also, the lowest is a little less than half the mean.

Studies also have been made to ascertain what forces average individuals are capable of exerting on various kinds of levers in various positions. A summary of a comprehensive study of that kind is presented in Table II.

Studies of human strength may reveal the largest force that is likely to be applied in any case, but not necessarily a reasonable minimum. Actual exertion is not always an operator's utmost. In many cases, the willingness of an operator may have more bearing upon the effort he puts forth than does his ability. The frequency of an action has a decided influence upon willingness. A person is more able and willing to do his best if called upon only at intervals, instead of continuously, to exert himself. In any case, a reasonable figure for a probable lower level of performance must be estimated on the basis of what an operator is likely to do as well as what he can do.

Air and Hydraulic Sources of Clamping Forces

Forces derived from air or hydraulic sources are more readily calculable than human effort. Even so, some variation may be expected. Most factories have air under 80 to 100 psi pressure, but in many places it may drop as low as 40 to 50 pounds in remote areas, especially if the compressors are overburdened (6). Commercial units for hydraulic pressure are available from many suppliers and manufacturers, and their ratings are found in catalogues. Pressures up to 1000 to 2000 psi can be had, even higher if desired.

A cylinder and piston make up the usual means of utilizing air or hydraulic pressures. Clamping pressure is preferably applied to the rod side of the piston, and the resulting force must be ample for the application. Releasing pressure then acts upon the full piston area, giving a larger force and reducing the likelihood of sticking.

For an air or hydraulic cylinder, the clamping force delivered in pounds is

$$\begin{aligned} F_c &= A_R P \\ &= (A_F - A_L) P \\ &= \frac{\pi}{4}(D^2 - d^2) P = 0.7854 (D^2 - d^2) P \qquad (1) \end{aligned}$$

where A_R = area on the rode side of the piston, sq in.

A_F = full area of piston, sq in.

A_L = cross-sectional area of rod, sq in.

D = diameter of piston, in.

d = diameter of rod, in.

P = air or hydraulic pressure, psi

Friction

The effort expended on a clamping device is largely dissipated in friction. Some of the losses always reduce the net results obtained. Also, most clamping devices are self-locking because of the presence of frictional forces. No

TABLE I—RESULTS OF STRENGTH TESTS

	FORCE IN POUNDS					
Event	Max.	Mean	Min.	Max / Min.	Min. / Mean	Source
Grip	166	109	52	3.2	.48	(a)
	148	95	42	3.3	.44	(b)
	154	103	52	3.0	.51	(c)
R. Grip	183	124	65	2.8	.52	(d)
L. Grip	165	113	61	2.7	.54	(d)
Back Lift	568	364	160	3.6	.44	(a)
	496	314	132	3.8	.42	(b)
	545	368	191	2.9	.52	(c)
	541	343	145	3.7	.42	(d)
Leg Lift	1012	617	322	3.5	.52	(d)
Arm Push	464	252	40	11.6	.16	(d)
Arm Pull	115	79	33	3.5	.42	(d)
				4.0	.45	Average

(a) 10,593 employed males—14-65 years of age.

(b) 1,328 unemployed males—14-65 years of age.

(c) 1,735 students—16-40 years of age.
Reported by E. P. Cathcart, E. R. Hughes and J. G. Chalmers, "The Physique of Man in Industry." Industrial Health Research Board, Medical Research Council, London, England, No. 71, 1935.

(d) Averages for 250 entering college men reported by F. W. Cozens—"Strength Tests as Measures of General Athletic Ability in College Men," Research Quarterly of American Association for Health and Physical Education, Vol. XI, No. 1, March, 1940.

TABLE II—SUMMARY OF MANUAL FORCES EXERTED ON VARIOUS TYPES OF LEVERS

		Average Force Lb
Single Lever—	push or pull vertically from about 20 to 35 inches above floor level	95
	from about 35 to 50 ins. above floor level	65
Single Lever—	push or pull horizontally	65
Crossbars—	push and pull vertically or horizontally, unfavorable positions eliminated	160
Handwheel—	vertical and parallel to body	125
	vertical and perpendicular to body	160
	horizontal	140

These figures are intended to give an approximate idea of forces that can be exerted on controls. The actual force in any case varies considerably with the position of the control and the physique of the operator. The values provide a rough guide for estimating reasonable loads for clamping devices.

The averages are based on studies of W. P. Kuhne, "Studies on the Optimum Force Exerted on Machine Controls," Industrielle Psychotechnik, Vol. 3, No. 6, pages 167-172, June, 1926, as reported by R. M. Barnes, Motion and Time Study, page 239, John Wiley and Sons, Inc., 1940.

satisfactory appraisal of clamping devices can be made without taking friction into account. Unfortunately, the exact intensity of friction cannot be foretold in most cases. But an understanding of the nature of friction is helpful for estimating extreme conditions, for which provisions can be made.

Numerous experiments have revealed how the coefficient of friction varies for certain conditions. Comparative tests have shown how the coefficient of friction between surfaces is affected by the presence or lack of lubrication, the materials in contact, surface smoothness or roughness, pressure, velocity, and vibration.

Lubrication

For well lubricated surfaces the laws of friction are considerably different from those governing dry or poorly lubricated surfaces. Really well lubricated surfaces are looked upon as those in an oil bath, where the frictional characteristics approach those of the lubricating medium. Such conditions are rarely encountered in tools. Even so, the difference between partial lubrication and no lubrication at all is still marked. For steel on cast iron, the coefficient of friction has been reported 0.204 for dry surfaces but only 0.108 for unctuous conditions (7).

Material and Surface Conditions

Although the coefficient of friction varies widely with many different materials, that variation is mitigated by the fact that only a few materials (steel, cast iron, and bronze) are found in most clamping devices. Among this assortment, the findings of Ham and Ryan (see Table III) and others have indicated that the effect of the material is of much less consequence than that of the hardness and finish of the surfaces. The effect of the last two factors is evidenced by the range of a coefficient of friction from 0.02 to 0.05 for hardened and polished steel surfaces (8) to as high as 0.15 to 0.20 for soft steel or cast iron surfaces (7) under similar conditions.

Pressure

Tests at high pressures, beyond the range covered in Table III, have indicated a substantial increase in the coefficient of friction. For steel and cast iron surfaces slightly lubricated, the coefficient of friction has been found to rise to about 0.40 at pressures just below seizure (9). This emphasizes the necessity of providing ample bearing areas in clamps to keep pressures within ordinary working ranges.

Speed

At high speeds the coefficient of friction is known to decrease, (10) but that is usually irrelevant to clamping mechanisms operated at low speeds. Of importance, however, is the fact that starting friction is normally in excess of running friction, about 1.38 to 1 according to Table III.

Vibration

Tests to determine starting friction in the presence of vibration show the coefficient reduced by this disturbance; the more the disturbance, the less the friction (7). This is significant for many clamps which hold a locked position because of friction. If vibration is likely to be present, and it often is in metal cutting, the clamp must be proportioned on the basis of a low coefficient of friction if stability is to be assured.

General Effects of Friction

It is evident that a coefficient of friction for one set of conditions does not usually apply to another set. Of more significance, though, is the impossibility of forecasting the actual status of every factor in any specific operation. Lubrication is one factor that furnishes a ready example. The lubrication of clamps in service is frequently neglected, but it is not always safe to assume that lubrication will never be applied. An oiled clamp is more efficient and imposes larger loads than a dry one. The larger loads mean greater reactions resulting in higher stresses in the members. Also, less friction may mean a lower margin of safety in locking. For such a contingency, it may be desirable to choose a low coefficient of friction in making provisions for some factors, and wise to select a large value for the coefficient for other factors. Since the most accuracy we can hope for in specifying friction is that of fixing limiting conditions for a particular situation, clamping calculations can only be expected to show limiting conditions. Actual performances can reasonably be expected to fall somewhere within judiciously set limits.

TABLE III—SUMMARY OF TESTS ON COEFFICIENT OF FRICTION[a]

Steel Screw and Bronze or Cast Iron Nut—Friction of Threads		Thrust Collar Friction		
Condition	Average Coefficient of Running Friction	Material	Coefficient of Friction: Starting	Coefficient of Friction: Running
High grade materials and workmanship and well lubricated.	.100	Soft steel on C.Iron	0.170	0.121
		Hard steel on C.Iron	0.147	0.092
		Soft steel on Bronze	0.101	0.084
		Hard steel on Bronze	0.081	0.063
For screw threads of average quality of materials and workmanship, operating under average conditions.	.125			
For screw threads of poor quality of materials and workmanship, for newly machined surfaces, slow and intermittent motion and indifferent lubrication.	.150	For loads up to 1800 pounds per square inch and speeds as high as 90 inches per minute. Average ratio of starting to running friction. 1.37 to 1.		
For loads up to 5000 lb. per sq. in. and speeds as high as 561 in. per min. Average ratio of starting to running friction, 1.38 to 1.				

a. As reported by C. W. Ham and D. G. Ryan, "An Experimental Investigation of the Friction of Screw Threads," University of Illinois Engineering Experiment Station Bulletin No. 247, June 1932.

The Wedge

One of the typical applications of the wedge is that of a locking device for a jig lid as shown in Fig. 1. In that capacity, the wedge must remain in place after it is inserted but not be too difficult to remove. The angle of the wedge determines how well it meets those requirements.

The Angle of a Wedge and the Forces on It

The diagram in Fig. 1 shows the forces acting on the wedge at the instant removal begins. It is assumed that the wedge has previously been inserted to exert a clamping force F_3 on the leaf, with a reaction F_1 from the post. F_1 and F_3 act normal to the bearing surfaces. The taper angle of the top of the wedge is α. Two friction forces, F_2 and F_4, resist removal of the wedge by pull P. For a coefficient of friction designated by f,

$$F_2 = fF_1$$

and $$F_4 = fF_3$$

Because the sum of the vertical forces equal zero,

$$F_3 = F_1 \cos \alpha + F_2 \sin \alpha$$

$$= F_1 (\cos \alpha + f \sin \alpha)$$

Also, since the horizontal forces must equal zero,

$$P = F_2 \cos \alpha + F_4 - F_1 \sin \alpha$$

$$= F_1 [\, 2f \cos \alpha + (f^2 - 1) \sin \alpha]$$

Since f is small, f^2 is much smaller and may be neglected, so that

$$P = F_1 (2f \cos \alpha - \sin \alpha) \qquad (2)$$

For small values of α, $2f \cos \alpha$ is larger than $\sin \alpha$, and a positive effort is required to extract the wedge. As α is made larger, $\cos \alpha$ decreases and $\sin \alpha$ increases. An angle is reached where P becomes zero, where the wedge no longer stays in place of its own accord. For large angles, P has increasingly negative values, which means there is less and less inclination for the wedge to remain in place. If equation (2) is solved for $P = O$, the result is

$$\tan \alpha = 2f \qquad (3)$$

This means that α must be an angle having a tangent less than twice the value of the coefficient of friction, if the wedge is to stay tight. However, it is not desirable that the angle be too small, because then the wedge is inclined to stick. That is, the pull P to remove the wedge becomes very large.

Practical Wedge Angles

For a coefficient of friction of 0.15, α by equation (3) is around 16 deg. A taper angle of over 16 degrees is almost sure not to stay put. But in the presence of oil and other favorable conditions, f may drop below 0.1, for which an angle less than 10 deg is required. A practical working angle for tapered keys is 7 deg (10).

Summary

Clamping devices must provide leverage, stay locked, and have ample strength. The proportions that a clamp should have to possess these properties can be derived from the principles of mechanics.

Clamping devices make use of variations of the wedge, screw, cam, lever, and toggle. Each has certain characteristics of its own which must be taken into account in analyzing it, but for the analysis of all clamping devices there are certain general considerations. These are the force to be imposed by the clamp, the force available to actuate it, and the friction ever present in its mechanism.

A clamp must impose enough force in any case to counteract fully the effects of the cutting forces which may act under extreme conditions. An estimate of what the cutting forces may be under specific circumstances can be made on the basis of the results shown by metal cutting studies.

If a clamp is manually operated, the forces applied to it may vary quite widely. The limits of the range can be estimated on the basis of studies of human strengths. Air or hydraulic sources of clamping forces are more stable and subject to calculations.

No precise figure can be given for the value of the coefficient of friction in any clamping mechanism, but limiting conditions can be estimated from the general knowledge of its behavior. Friction is low in the presence of lubrication. Surface conditions have a greater influence than the actual materials in contact. Generally, hard smooth surfaces have a lower coefficient of friction than soft rough ones. At pressures approaching seizure, the coefficient of friction reaches a maximum value. Starting friction is about a third more than running friction. Vibrations tend to decrease the coefficient of friction; a fact which should not be overlooked in metal cutting operations.

The tangent of the angle of inclination of a wedge must be less than twice the coefficient of friction, if the wedge is to stay tight. For small angles, the wedge is inclined to stick, and a definite force must be applied to remove it. For large angles, a force must be imposed to hold the wedge in place.

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Atomic Energy Possibilities in Industry

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THE INDUSTRIAL UTILIZATION of atomic energy presents a new and fascinating field for engineers. Of prime interest among mechanical engineers is the production of atomic power. However, in addition to power, atomic energy can and is furnishing invaluable assistance in solving many biological, medical and engineering problems through the production of radio-isotopes which are useful as tracers in experimental investigations.

Before attempting to appraise the usefulness of these new atomic tools it might be well to look at the fundamentals of atomic energy and see what we have to work with. Atomic energy, or more specifically nuclear energy, is evolved in the form of heat in a so-called reactor or pile. The word pile arose from the fact that reactors were built by carefully piling the appropriate materials to obtain a chain reaction. This heat in the reactor is produced by fissioning of uranium under bombardment by neutrons. The neutron, you will recall, is the uncharged particle which along with the positively charged proton is found in the nuclei of the atoms. It is now generally believed that the nuclei of all atoms consist of protons and neutrons.

The number of protons in the nucleus determines its atomic number and the sum of the protons and neutrons gives its mass number. The positive charge due to the protons in the nucleus of the neutral atom is of course, neutralized by the orbital electrons. Now an atom of a particular element can have more than one type of structure, in that it may have a larger or smaller number of neutrons; however an atom of a given element always has the same number of protons. Such atoms, therefore, have the same atomic number but different mass numbers. They are called isotopes. They are chemically identical, and cannot be distinguished by chemical means. For example, all species of uranium have an atomic number of 92; that is, they all contain 92 protons. The various isotopes U^{234}, U^{235} and U^{238} have different mass numbers or atomic weights due to the presence of different numbers of neutrons in the nuclei in each case.

The early development of atomic theory was based on the hypothesis that the atoms of any one element could not be converted into those of another. As early as 1896, however, the French physicist Becquerel discovered that uranium continuously emitted energy in a form which could penetrate matter opaque to light and still affect a photographic plate. The uranium appeared to be disintegrating. This discovery led to many theories and interesting experiments led by Pierre and Marie Curie and others. It was not until 1932, however, that transmutation of the elements was achieved when Cockroft and Wilson, in England, bombarded lithium with protons and obtained helium. This experiment led to extensive work with high speed particle accelerators or "atom smashers" which were widely publicized just before World War II.

As described in the Smyth Report[2], among these experiments of nuclear bombardment one particularly interesting reaction encountered was that caused by neutron bombardment of uranium. This reaction was first studied by Fermi and his colleagues in 1934 but it was not properly interpreted until several years later when in 1939 Niels Bohr brought from Denmark the hypothesis of two of his colleagues, O. R. Frisch and L. Meitner, that the absorption of a neutron by a uranium nucleus sometimes caused that nucleus to split into approximately equal parts with the release of enormous quantities of energy. This splitting process soon took on the name of fission.

Bohr's announcement stimulated a great deal of interest in this country. Calculations and experiments by various scientists showed that in addition to this energy an excess of neutrons appeared from fission. This concept opened up the possibility of a chain reaction because extra neutrons became immediately available for further nuclear reactions. By 1940 theoretical and experimental work showed many important facts. Significant among these facts were that uranium could be made to fission with either fast or slow (thermal velocity) neutrons, that in naturally occurring uranium, only the isotope U^{235} underwent fission with thermal neutrons and that fast neutrons were not as effective as thermal neutrons in producing fission in U^{238}.

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[1] On loan from Westinghouse Electric Corporation.

[2] *Atomic Energy for Military Purposes*, by Henry D. Smyth, Princeton University Press.

On the basis of this information, then, to produce a chain reacting pile we must:

1. Have U^{235} or other fissionable material: The isotope U^{235} makes up only about 0.7 percent of the naturally occurring uranium. The desire for concentrating the U^{235} is what led to the large isotope separation plants at Oak Ridge, Tennessee. As described later, other fissionable materials such as Pu^{239} and U^{233} can also be used to produce a chain reaction.

2. Slow down neutrons from fission energy to thermal equilibrium energy to get good utilization. If we assume a reactor temperature of 1500 deg F, we find that the equilibrium neutron energy is 0.09[3] ev. and the corresponding velocity is 2.7 miles per second whereas a 2 Mev neutron released in fission has a velocity of about 12,000 miles per second and corresponds to a temperature of 30 billion degrees Fahrenheit. On this basis, if materials would permit, we could certainly produce efficient heat cycles but materials, of course, do limit us to lower temperatures.

The neutrons are slowed down by colliding with nuclei of the atoms and giving up their energies. The material used to slow down the neutrons is called a moderator. For this purpose the light elements are best because their nuclear masses are close to the mass of the neutron. Heavy elements are not good moderators because the inertia of a heavy nucleus would cause the neutron to rebound without appreciable loss of its incident velocity.

[3]In speaking of single neutron reactions, the physicist uses a different unit of energy, from those common to engineering; it is the electron volt which is defined as the energy imparted to an electron as it falls through a potential of one volt. It is usually abbreviated as ev; millions of electrons are designated as Mev.
1 Btu = 6.65×10^{15} Mev   1 erg = 6.25×10^{5} Mev

Since atomic nuclei occupy only a small portion of the volume of matter the nucleus presents a very small target to neutrons. Nevertheless, the concept of cross-sectional area of nuclei is used to compute the effective target area for a particular collision between a neutron and a nucleus. A term of frequent use in this connection is the so-called cross-section of an atom. The cross-section for a particular nuclear reaction is defined as the effective nuclear target area that a neutron must strike in order to produce the particular nuclear reaction. Cross-sections are generally of two kinds—those relating to scattering and those relating to capture or absorption. Although these cross-sections may be either smaller or larger than the geometric cross-sectional area of a nucleus this value of nuclear area, which is of the order of 10^{-24} cm^2, is used as the unit of cross-section and is called a barn, presumably because this is the target whose side the neutron would have difficulty in hitting.

Scattering cross-sections are generally of the order of a few barns. Good scattering cross-sections are required in moderators. Absorption cross-sections extend from less than a barn to several thousand barns for the different elements. Highly absorbing materials like cadmium and boron are called nuclear poisons and are useful in controlling the chain reaction.

3. Build the reactor so that of the neutrons produced in fission enough are available to produce further fission.

As outlined in the Smyth report we have in a pile four competing processes:

a. Escape

b. Non-fission capture by uranium

c. Non-fission capture by impurities

d. Fission capture

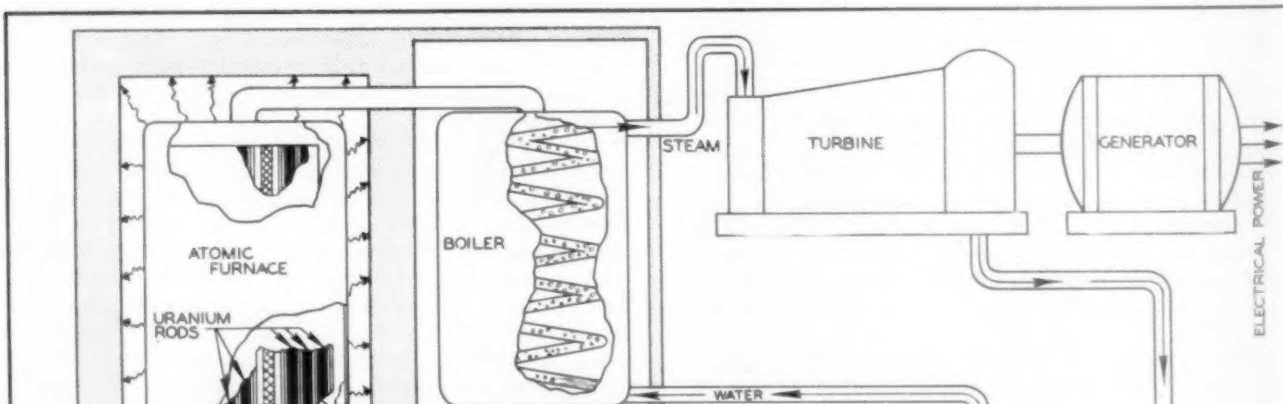


Fig. 1. Schematic diagram of a reactor installation for the generation of steam for electrical energy.

If the neutrons lost by these processes is less or just equal to the neutrons resulting from fission we get a chain reaction. If these losses are greater we do not get a chain reaction. Fundamentally the concept is as simple as that.

Well, how do we assure the correct balance? First we can see that the number of neutrons which escape from the pile can be varied by changing its size and shape. The surface of a body through which neutrons escape varies roughly as its mean dimension squared while volume varies as the dimension cubed. Since leakage or escape is essentially a surface effect and fission capture essentially a volume effect, making the reactor big enough will reduce leakage. In order to reduce non-fission capture in uranium we enrich it as described before. The non-fission capture by impurities is controlled by using materials of construction which do not tend to capture neutrons. This requirement of course imposes severe limitations on the materials which can be used for reactor structure—particularly on the moderator.

The size of a particular configuration of uranium, moderator and impurities at which the chain reaction takes place is called the critical size. The critical size of a pile, then, is that size in which a balance is achieved between loss and production of neutrons.

So much for background. In application reactors may take many different forms. Reactors are generally classified according to the energy of neutrons they use, according to the enrichment of uranium, according to their construction, and according to their application. When classified as to neutron energy, reactors are either fast or thermal depending on whether or not the preponderance of fissions is caused by fast or thermal velocity neutrons. When classified according to enrichment of uranium, reactors are called either enriched or unenriched depending on whether or not they use concentrated fuel. A pile can be made to operate with natural uranium, but its possibilities are somewhat limited. When classified according to type of construction, reactors are either homogeneous or heterogeneous depending on whether or not the uranium is distributed throughout the reactor in a continuous fashion.

So far as application is concerned let us consider what reactors can be used for. As long as we have heat we can get power if the heat is produced at elevated temperature. In addition to energy, reactors produce neutrons and these in turn can be used to produce any of the numerous radioactive isotopes. Or these neutrons can be used to produce more or other fissionable material. For example, plutonium can be obtained from U^{238}, and U^{233} can be obtained from Th^{232} (thorium). Both PU^{239} and U^{233} are fissionable materials. It appears then that we can augment our supply of fissionable material by use of a "breeder" reactor. Thus it is conceivable that we might not only extract energy from U^{238} but that we might do so without a net expenditure of fissionable material.

To date neither the power breeder or the power reactor has been built, but work on both these types of reactors is in progress.

Let us look now at what the power reactor entails and what problems face its designer. One might consider using the reactor to boil water or heat gas and use this vapor or gas directly to drive a turbine. This method has the drawback, however, that the coolant in such a reactor will pick up a great deal of induced radioactivity or may become contaminated by fission products unless the fissionable material can be suitably encased. This radioactive steam or gas, if used directly in a turbine, would contaminate the entire plant and require shielding of all its components. This shielding would seriously hamper maintenance of the equipment. Lubrication would be a serious problem because present lubricants will break down under radiation. And yet this lubrication would have to be accomplished inside the shield. This shielding, of course, is prohibitive if we are considering an air or naval application.

In order to avoid shielding all of this equipment we can introduce a heat exchanger between the pile and turbine. Fig. 1 is an illustration of a plant incorporating such a heat exchanger. In this plant the reactor coolant is circulated entirely in a shielded loop, from the reactor to the heat exchanger or boiler and back to the reactor. In the heat exchanger the heat can be transferred to a conventional steam plant.

Examining Fig. 1, we see in the reactor an active core which contains the fissionable material and the moderator. What might this moderator be? A good moderator, besides being light, should have a low absorption cross-section to avoid parasitic loss of neutrons and it should have a good scattering cross-section with a sufficient density or compactness of atoms to provide the necessary moderation. This latter requirement of density eliminates the use of gases, particularly hydrogen and helium, as moderators except at extremely high pressures. Hydrogen and its isotope, heavy hydrogen, can be used, however, in the form of water and heavy water. Among the remaining light elements which might be used for moderating are lithium, beryllium, boron and carbon. Lithium and boron have high absorption cross-sections and therefore can be eliminated. This leaves as the moderators of practical importance, water, heavy water, beryllium and its compounds and carbon as graphite or as carbides.

Surrounding the core is a reflector of nonfissionable material having good scattering and low neutron absorpting characteristics. A certain number of neutrons leaving the core are returned to the core by the reflector and assist in the chain reaction. The reflector material may be the same as the core moderating material so that some of the fast neutrons which leave the core can be slowed down in the reflector and returned to the core as thermal neutrons. Although the reflector contains no fissionable material, it may contain fertile materials such as thorium to utilize for breeding purposes, insofar as possible, those neutrons which might otherwise leak from the reflector.

In the core is also noted a control rod. This rod is the key to controlling the chain reaction.

During the operation, a reactor consumes U^{235} and unless an excess of this nuclear fuel is provided in the reactor it becomes sub-critical and the chain reaction stops. The effect of this excess of fissionable material, however, must be counteracted until it is needed. This is usually done by inserting into the reactor control rods containing highly absorbing materials such as boron or cadmium.

The control rods are used to hold the reactor exactly critical at a constant power level. To increase the reactor power, the control rods are withdrawn to make the reactor slightly super-critical; with the rods withdrawn the power output is permitted to rise to the desired level and then the rods are returned to their original position to make the reactor exactly critical again. Of course, depletion of uranium or build-up of highly absorbing fission products may dictate new criticality positions for the control rods.

Let us see if we can develop a suitable analogy for this control. The one presented here is somewhat oversimplified but it illustrates the principle. Consider a tank of water with a pump discharging from the tank at roughly a constant rate. Let us have water flowing into the tank at the top through a pipe containing a valve. Now if we consider the level in the tank to be analogous to the power level in the reactor and if we consider the valve to be a control rod then we can see that by proper positioning of the valve we can maintain a constant level in the tank. To increase the level we merely open the valve wider to permit more flow into the tank until the water reaches the level desired and

then bring the valve back to its original position. This is essentially what is done in the reactor by use of a control rod.

Due to rapid multiplication rate of neutrons, in even a slightly super-critical pile, the operation of control rods must be rapid, the order of tenths of a second. The necessity for rapid action of control rods is offset somewhat by the fact that about 0.76 percent of the neutrons produced from fission are delayed. These delayed neutrons help the control problem by introducing a time lag between subcriticality and supercriticality of the reactor as the control rods are withdrawn.

Because of the intense pile radiation, the control apparatus must be remotely operated; it must also be reliable.

Getting back to our reactor, we come now to the problem of extracting the heat generated by fission. This at first seemed like a straightforward job, but it has developed that, because of nuclear limitations, the problem is quite beyond the scope of normal heat removal practice.

First of all, our coolant must have a low neutron absorption cross-section. Secondly, it must not react with the moderator or uranium. Third, it should have better than average heat transfer characteristics and fourth, it should not decompose under pile irradiation.

The first requirement puts air and water in a poor light because of oxidation and corrosion. Sheathing helps alleviate these problems but we have then the problem of finding an acceptable sheath with a low absorption cross-section for high temperature operation. Aluminum has been used successfully at moderate temperatures but is not practical for high temperature operation.

Helium would pass the first and third requirements but in order to meet the second requirement it necessitates a large amount of pumping power. Certain liquid metals appear promising but their technology must be developed. Organic coolants are not attractive because they tend to decompose.

The problem is not hopeless however; a compromise of requirements can be made, but the work requires extensive development.

Now we have said that neutrons are released during fission. In addition to neutrons, gamma rays (hard x-rays) are emitted during the action of the pile and both the neutrons and gamma rays are extremely penetrating. It is necessary to surround the pile with walls of concrete of the order of 5 feet thick.

Having looked at shielding and control and heat removal we can begin to appreciate some of the problems that confront the designer of a nuclear power plant. Let us summarize the more important.

1. The materials that can be used in a reactor are limited and in order to obtain reasonable thermodynamic efficiency it is necessary to operate at temperatures above the usual engineering range for many of these materials.

2. The reactor materials must not only withstand high temperatures but also the intense neutron and gamma radiations of the reactor, without changing their engineering properties.

3. In addition these materials must have low neutron absorption cross-sections.

4. As we have said before, the reactor consumes only a portion of the uranium placed in the pile. This means that if the undepleted uranium is to be used again in a reactor it must be reclaimed. This poses a difficult fuel reprocessing problem with highly radioactive materials.

5. The nuclear limitations on reactor materials and coolant properties introduce serious difficulties in the removal of heat from the reactor. These difficulties include all the associated problems of corrosion, erosion and pumping.

6. The intense neutron and gamma radiation from the reactor necessitates the use of a heavy shield with its accompanying handicaps.

This list is imposing but work is going on to solve these problems in the various Atomic Energy Commission laboratories and in the laboratories of numerous industrial concerns and universities cooperating on special problems. This is the activity which has occupied the attention of atomic power engineers during the past several years. We are now at the point where we can attempt the construction of several high power reactors. The construction of such reactors occupies an important part in the program of the Atomic Energy Commission. All of these first reactors, however, must of necessity be experimental in nature. It may take another ten to twenty years before these reactors are finally developed for commercial use.

As described by Dr. Robert F. Bacher, former commissioner, and L. F. Hafstead, director of reactor development of AEC, the current reactor program is concerned with the development of four different reactors:

a. The first of these is a materials testing reactor. It is an experimental reactor, intended for testing of reactor materials in high neutron fluxes. Development of this design is being carried on jointly by the Argonne National Laboratory and the Oak Ridge National Laboratory; preparation of engineering details is being done by Blaw-Knox of Pittsburgh, Pa.

b. The second reactor is a land-based prototype of a naval reactor. It is being designed specifically for the production of power which could be used to drive a ship. This is the plant to be designed at Argonne National Laboratory and built by Westinghouse Electric Corporation.

c. The third reactor is an experimental reactor designed specifically to study breeding. This reactor has been designed and the core is to be built by the Argonne National Laboratory; engineering design work is being carried on by the Austin Company of Cleveland, Ohio; construction of all but the core is to be done by the Bechtel Corporation of San Francisco. This reactor is not intended to produce large amounts of net power, but to investigate the problems involved in obtaining a net gain in nuclear fuels.

d. The fourth reactor is intended to produce a significant amount of power and at the same time demonstrate breeding. This reactor is being designed and constructed by the General Electric Company at the Knolls Atomic Power Laboratory near Schenectady, N. Y. The reactor, if successful in all respects, will be one of the most significant steps in the application of nuclear energy to the production of commercial power. Breeding, or extensive conversion of fertile materials into fissionable materials, is necessary if large scale use of nuclear power is not to deplete our supply of currently available fissionable materials.

The question of the cost of nuclear energy plants of course is of vital interest to engineers. On the basis of present estimates the large investment costs of the nuclear power plant do not make it as attractive as coal fired plants for production of power in the highly industrialized coal producing areas. The power costs are sufficiently comparable however as to make nuclear power plants commercially feasible in areas where coal transportation charges are high. Further developments of nuclear power plants, of course will modify any early comparisons that can be made at this time, but at least from an economic standpoint at present the next dressing, when the process is repeated.

Broaching Small Holes of Irregular Outline

By Edward Diskavich

PRODUCTION OF SMALL holes such as those shown in Fig. 1 demands careful selection of the most advantageous technique. If a depression is involved such as in a plastic molding die, hobbing might be used, and the material worked would be one of the soft hobbing steels. If holes of this shape are to be put in a tool where the stock is only one-eighth of an inch, filing the hole and working with a punch to get the desired shape is practical. But when the material for the job calls for a tough oil-hardening tool steel, such as for a blanking die or a sintered metal die, and the depth of the hole is one-quarter or three-eighths of an inch, then a different approach to the problem must be used to get an accurate hole, consistent with time-saving.

This hole (Fig. 1) has the shape of a circle, but with a flat side. The 0.093 in. hole is first drilled or bored offset 1/32 in. with the finished hole and then worked out to about 0.122 in., using an end-mill which has been ground extra long (from an end-mill in stock). If the job permits, half the depth can be worked from the other end. Of course the job could be set up on a vertical milling machine, or even a boring mill. But so far the shape of the finished hole has not been reached, as the end-mill leaves an undesired radius (Fig. 2). To finish the hole a broach is made (Fig. 3). The flat is ground after hardening, as are the flutes. Made this way the broach will cut fairly well. Use a good tool steel, such as those specified for cutting tools.

On the broach will cut also on the flattened portion. If this is not provided for, the broach will tend to push over, and an excessive amount of stock will be removed from the circular part of the hole.

The broach is pushed through the work in an arbor press, slowly, using cutting oil. If the broach "sticks" and won't move, it must be pushed out from the other end, and the chips removed. Care must be used, since the broach is so thin in relation to its length and is easy to break. As the chips accumulate in the flutes, even for a small job such as this the broach doesn't "fall through".

The pentagon-shaped hole is perhaps easier but has its own peculiar characteristics. Here no milling is possible, and filing the hole is very slow, and furthermore calls for a high degree of workmanship. Because there is considerable stock to remove, it is desirable here to make two broaches, one for roughing, the other for finishing, as the second broach is made to remove less stock per tooth. These are shown in Fig. 4.

To work out this hole, bore or drill (depending on accuracy called for) the minimum diameter in the workpiece, then push the first broach through in the arbor press. The broach must be kept straight, and must be taken out occasionally for chip removal. After the hole gets started, a three-square "needle" file used discreetly will help the job along.

In grinding the pentagon broaches, after hardening, a jig fitted with an index plate is needed. The broach is supported on centers. Unless such a device is already on hand, a holder such as in Fig. 5 can be made.

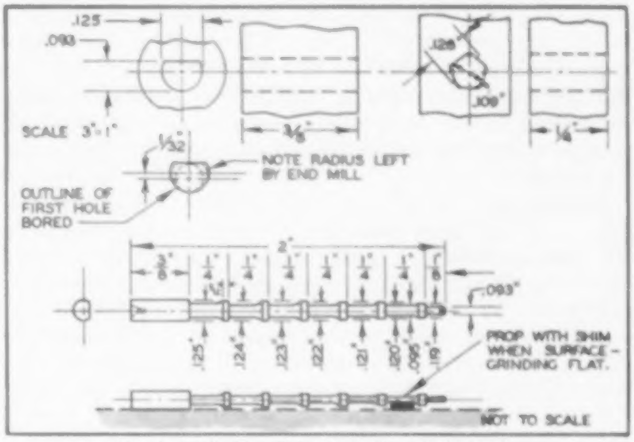


Fig. 1 (top); Fig. 2 (center); Fig. 3 (bottom).

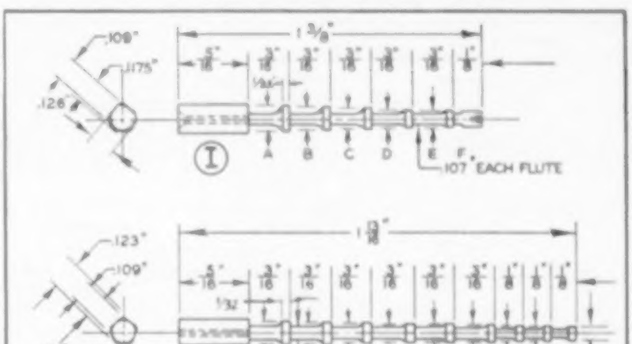


Fig. 4 is the finish broach. On both broaches, grind flutes and pentagon shape after hardening. Leave 0.007 in. oversize to grind; leave 0.25 in. shank on broaches. Dimensions are as follows:

I	II
A 0.1255 in. circular diam	A 0.122 in. circular diam
B 0.125	B 0.121
C 0.1245	C 0.120
D 0.124	D 0.119
E 0.1235	E 0.1175
F 0.123	F 0.115
	G 0.1135
	H 0.1115

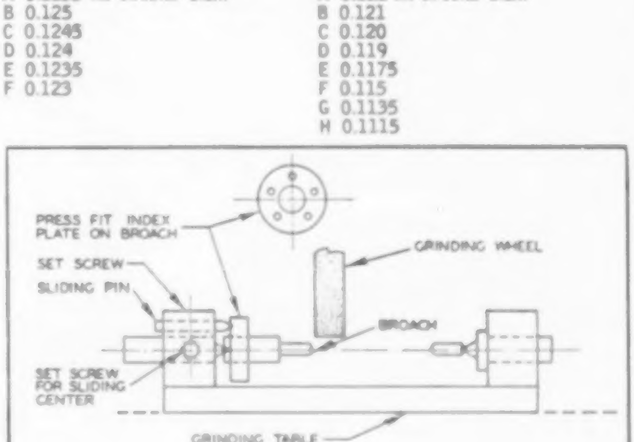


Fig. 5. This fixture grinds five sizes on broaches.

Tooling for Thermoplastic Materials

By N. C. Taylor
SERVICE ENGINEER
TENNESSEE EASTMAN CORPORATION

Basic considerations in tooling for injection molding of thermoplastics applications involve material selection, product design, tool design for the product and proper molding technique.

Selection of material is an initial consideration when molding a product from thermoplastic material. We first ask the question, "Will the specific material selected do a quality job as to the physical properties and color required?" The quality of the product may be endangered if proper consideration is not given to the physical properties required, that is, impact strength, tensile strength, aging, water absorption, etc. Also, will the cost of the basic material permit its use in the application? Can the material be molded economically after these preliminary questions have been answered? A few good applications which are molded in cellulose ester thermoplastic and the physical properties that were considered in selecting the right material for these jobs are shown in Table I.

Table I—Physical Properties Required of Various Thermoplastic Applications

APPLICATION	PHYSICAL PROPERTIES
Screwdriver handles	Impact strength Compressive and tensile strength Accelerated aging
Telephone housings	Impact strength Accelerated aging Dimensional stability
Fishnet floats	Water absorption Impact strength Dimensional stability
Toilet seats	Dimensional stability Impact strength Lack of cold flow
Vacuum cleaner parts	Heat distortion Impact strength Dimensional stability
Toothbrushes	Machinability Flexural strength Water absorption
Automobile steering wheels	Elongation Impact strength Aging properties Dimensional stability

Product design is the next step in tooling for a thermoplastic where at least an equal number of mistakes are made as in the selection of material. Almost any application can be poorly designed and thus appear to show the material to be unsuitable. In planning a well-designed part, it is necessary to maintain as uniform wall sections as possible; sharp corners should be eliminated. Core out heavy sections and use metal inserts where they are practical rather than putting screw threads directly into the plastic. It is important that the design of the product conforms with good tool design for molding the application. For example, the part should be designed to allow plenty of draft on all cavities and cores of the mold so the part can be taken from the mold without interruption of the machine cycle. The part should be so designed as to permit proper venting of the mold to allow the escape of excess gas, thereby preventing weld lines, brittle castings, and undesirable surface finishes. Large area castings should be reinforced with ribs to add stiffness and strength. Equally important, ribs provide additional runner area in the casting to allow it to fill with a minimum injection pressure. This may not always be possible, but certainly should be adhered to if difficulty in toolmaking and in molding the article are to be avoided.

Following design and material selection, it is advisable to fabricate at least one model of the article using the selected material for use in designing the tool. From an accurately machined model and detailed drawing, toolmakers' drawings are made. The toolmaker must consider the following points in designing and building the tool. First is the type of metal

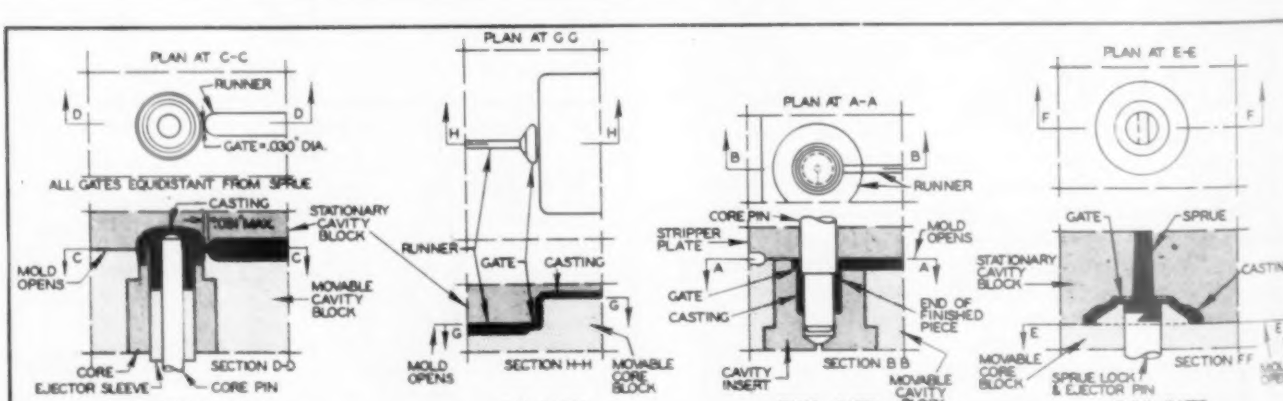


Fig. 1 Above are shown four typical gate designs which reduce air entrapment and aid casting finish.

to be used for the mold itself—which includes the cavities and the cores, the cavity and core back-up plates, the die shoe, the knock-out pins, the sprue bushing and the locating pins. Selection of specific metals for these parts must be made from the standpoints of wear resistance, toughness and the resistance to corrosion. The cavities and cores are usually made from air or oil hardening steel and a Rockwell hardness of 42 to 50 is considered satisfactory. On knock-out pins of $\frac{3}{16}$ in. diameter and larger a Rockwell hardness of 46 to 50 fulfills the requirements. (Smaller pins might have 42 to 46 Rockwell hardness.)

A back-up plate is used behind cavities and cores to prevent them from hobbing into the die shoe and has a Rockwell hardness of 46 to 50. The use of hard back-up plates is strongly recommended for cavities and cores to prolong the life of the mold since it has been found that when mounting cavities and cores in a soft die shoe it is difficult to keep the cavity surfaces in line to prevent mold flash. Die shoes customarily are made from a mild steel, and it is recommended that the outside surface of the die shoe be finished in a manner to allow the mold to be wiped clean with as little difficulty as possible. SAE series 1000 steels are satisfactory. Cavities and cores are made from oil and air hardening steels in the SAE series 3000, 5000 and 6000. Back-up plates, core pins, sprue bushings and knock-out pins are found to be satisfactory using the same series which are used in the cavities and cores. Cast beryllium copper and stainless steel castings are fairly widely utilized in the industry for cavities and cores. Cast iron cavities and Kirksite have been used by special mountings in the die shoe, but these are not considered as materials for injection molds, other than sample molds, up to this time.

In mold design, after the steel has been selected, the following considerations should be adhered to:

1. Proper draft on all cores and cavities. (Actually this point goes back to "Product Design")

2. All cavities and cores must be perfectly anchored in the die shoe and in perfect alignment.

3. All movable parts must have ample clearance to prevent galling and sticking. This applies to locating pins, knockout pins, stripper plates, automatic unscrewing cores and cavities, and all movable cores in the mold.

4. All cavities must be properly vented to allow air escape. As the mold is filled, it is considered satisfactory to use vents $\frac{1}{8}$ in. wide, 0.002 in. deep from the cavity to the outside of the mold. It may be necessary, however, to put a number of these vents into a given cavity to allow ample venting of the casting. Some molds, due to their construction, naturally lend themselves to properly venting the mold in the first place. When it is impossible to vent a casting at the parting line of the mold, sufficient clearance should be provided around pins to prevent the escape of air through the back of the mold.

5. Material shrinkage must be considered when designing the size of the cavity and the core so as to come up with the proper dimensions on the finished part. Shrinkage allowance of about 0.003 in. per lineal inch is recommended when designing for cellulose ester thermoplastic materials.

6. To give the best finish on castings, the cavity or core, or both, should be polished to a mirror finish since a thermoplastic material takes on the finish of the mold surface. A number of molds requiring a high luster finish on the molding are flash chrome plated with from 0.0004 to 0.0007 in. If more chrome than the above specified amount is applied to a given cavity or core, it has been found that in the sharp corners or even in the radius in the cavities or on the cores it will crack or peel, which, of course, will cause the castings coming from the mold to be marked and have an unsatisfactory finish.

7. Considerations of the sprue size, runner size, and gate size is a "must" in designing molds for good workability. Also to be considered is the location of the gate to the part to insure a strong casting and eliminate air trapping, weld lines, and bad finish in general. When it is advisable spot the gate on the mold, to leave an alternate way to change the mold if possible, since theory and practice do not always coincide. Four typical gate designs are shown in Fig. 1.

8. All injection molds should be provided with heating and cooling channels which will allow conditioning of the mold in operation. This is done either by drilling or coring

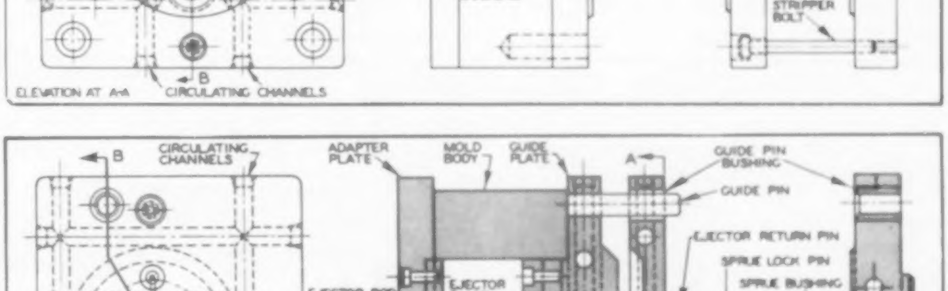


Fig. 2. This six-cavity mold with self-contained multiple auxiliary sprues was designed to produce a grip cap for the upper end of a golf-club shaft. Finishing of the cap consists of punching the disk with the auxiliary sprue from the center of the molded piece.

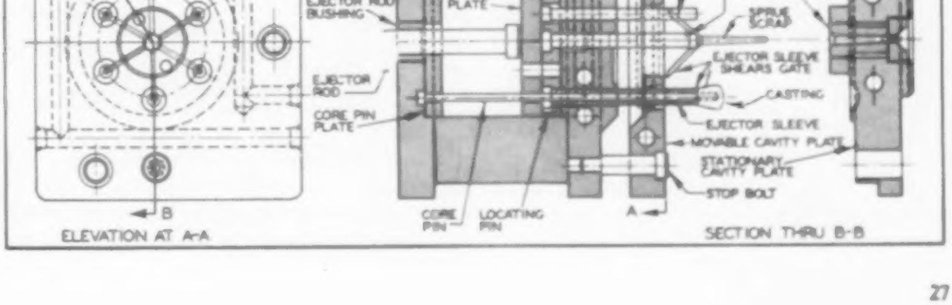


Fig. 3. Another six-cavity mold producing a knob for use with a press-fitted insert. Mold opens after injection cycle, molded knobs are stripped from core pins and drop free. Sprue lock-pins push sprue and runners through center hole of cavity plate, enabling sprue scrap to fall free.

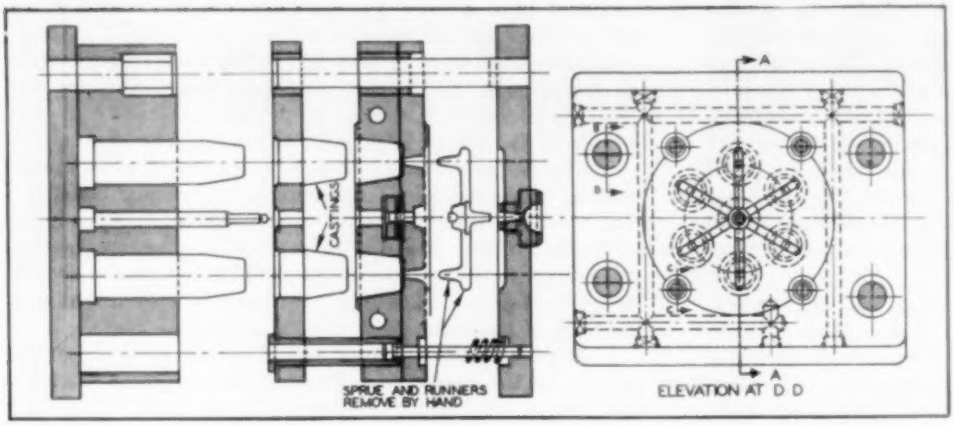


Fig. 4. This six-cavity mold was designed with an extra sprue plate. It consists of four parts as follows: adapter plate with main sprue bushing and half runners; cavity plate bolted to a plate with auxiliary sprues and half runners; stripper plate; and mold base consisting of corepin block and adapter plate.

out holes in the backplate used for supporting the cavities and cores, and in some cases it is necessary to provide water cooling into cores and directly into cavities in order to make the mold operate properly. (See Figs. 2, 3 and 4).

Injection molding technique is equally as important as any of the other points brought forth in this article in helping to make a good part from a thermoplastic. As a matter of fact, regardless of how well the part is designed, or how carefully the material is selected, the molder can make a poor molded part if faulty molding procedures are used. When considering injection molding a given application the size of the injection machine is a fundamental consideration. If an attempt is made to overload an injection machine with too large a mold, you not only get inferior molded parts, but the injection equipment may be taxed to the point of breakdown, resulting in excessive maintenance costs. Molds should be designed within the capacity of the machine on which it is to be run both from the specified weight in ounces that the machine will shoot and the recommended projected area the clamping pressure will hold closed. In other words, it is quite possible to design a mold with too large a projected area for the machine to hold closed and yet the piece may not weigh in ounces as much as the maximum capacity of the machine. Injection molding procedure is illustrated in Fig 5.

The length of time to complete a given shot is called the machine cycle. There are a number of considerations in trying to reach a given cycle and at the same time utilize all of the good properties in the material after it has been molded. First of all, it is necessary to heat the material to a plastic state prior to shooting it into the mold in order to obtain a casting free from brittleness, weld lines, cold flow lines, internal stresses and bad surface finish. On the other hand, it is possible to overheat the material, decomposing it to a state where inferior castings are a result. Therefore, the length of the cycle or the time that is necessary to make a shot should be carefully considered before a production run is made on a thermoplastic molded piece in order to maintain the good physical properties in the material.

Necessary facilities should be provided in a mold for heating or cooling the various parts of the mold. It has been found that hot molds greatly improve the properties of an injection molded casting, since a heated mold will generally fill with less injection pressure and cause less internal stress in the casting.

It has been found advisable in many cases to vary the speed of the injection ram on a machine, thereby changing the filling speed of the cavity and obtaining improved surface finishes. In many instances by slowing down the speed of the injection ram, excess gas is permitted to escape through vents as the mold is filled, eliminating the burning of the castings due to entrapped gas in the cavity or on the core.

Proper drying of cellulose ester plastic material prior to molding is another basic consideration in injection molding technique. If this precaution is not taken a number of undesirable conditions are observed: mica blisters on the surface, brittle castings, entrapped gas marks, poor weld lines and a general bad surface finish. Undried material in many instances will not allow a uniform cycle to be obtained on the machine which is necessary for good castings and economical operation. Improved injection molded parts generally come as a result of uniform molding conditions on long sustained runs. As a matter of fact, if a molded application can be allowed to run continually twenty-four hours a day a better part will result and less scrap will be produced, thereby reducing manufacturing cost.

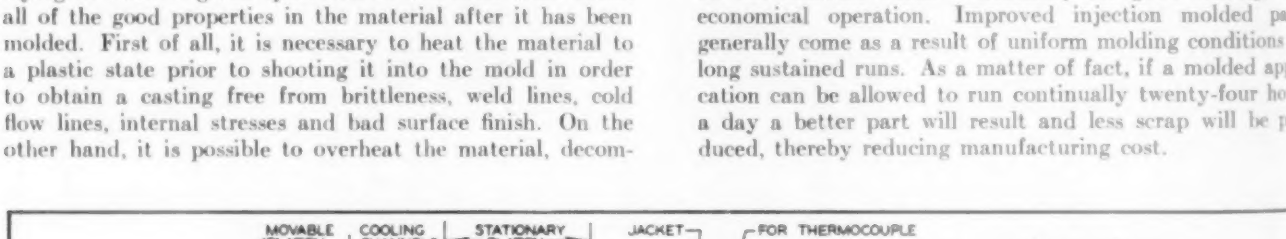


Fig. 5. Above is a sectional view illustrating the general method of injection molding.

Determining the Flute Form of a Helical Groove

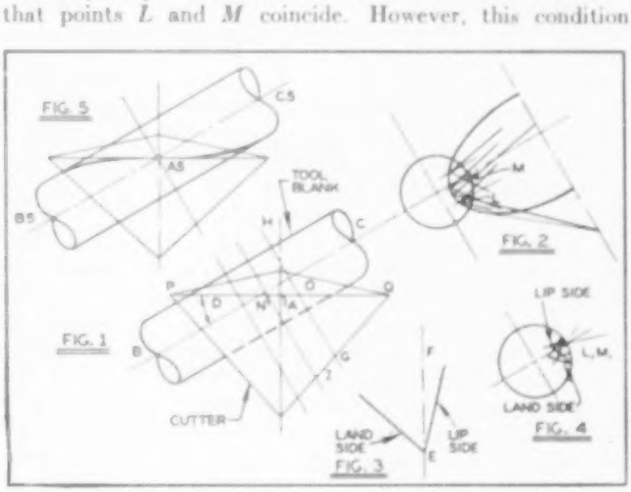
By H. O. Kosel

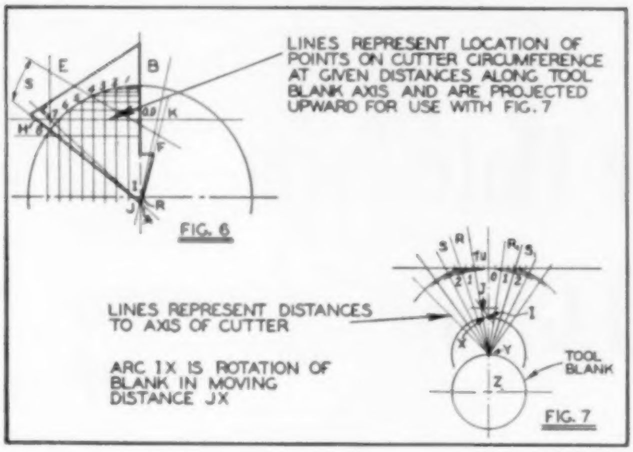
FREQUENTLY IN PRODUCING cutting tools it is difficult to reproduce the flute form of a helical reamer or cutter, even though drawings are at hand which show the flute depth, lip angle, radius at the bottom of the flute and sometimes table setting angle of the mill. In many instances the same gashing cutter is available, but it still may be necessary to make changes in the manufacturer's and the customer's drawings because of inability to mill a gash exactly the same.

The following graphic method of determining the form of the gash or flute, assuming a given gashing cutter and machine set-up, was developed by the writer. Although cumbersome for many tool operations, the method indicates that the shape of the cutter flute is dependent less on the shape of the gashing cutter than on the setting relative to the work. In helical work the same gashing cutter can be used to produce either a negative or positive rake in the same blank, set to the same depth and at the same helix angle, simply by moving the mill table in or out a slight amount. To reproduce the flute form of a cutter, the included angle of the gashing cutter and its radius, and the distance from the center of the gashing cutter (Point *A*, Fig. 1) to the centerline of the work-piece (Line *A-B*, Fig. 1), measured along the arbor of the milling machine, should be recorded. A description of the graphic method employed follows.

Figs. 1 and 2 are two views of a milling or gashing cutter and a tool blank where *A* is the center of the cutter, *BC* is the axis of the blank, and *D* is the angle of the spiral gash which it is desired to cut. Fig. 1 is a plan view and Fig. 2 is an elevation normal to the axis *BC* of the blank. To find the axial view of a spiral gash, draw the views of the various sections of the intersection of the cutter and the tool blank, and lay all of them in relation in a single view. Consider a tool blank or piece of round bar stock set up in the dividing head of a milling machine and a cut run into it vertically with the longitudinal feed disconnected. The notch formed will be a partial reproduction of the cutter, and its surfaces will be the limits of engagement of the cutter and the tool blank. Assume the cutter to be raised out of the cut and used to scribe a helical line on the circumference of the tool blank, the longitudinal feed being engaged. If now the notched portion of the blank is cut into thin discs which are stacked one on top the other with the scribed helical marks placed one above the other in a straight vertical line, the projection of the notch outlines on a single plane will show the axial outline of the spiral gash that the setup will produce.

It will be noted that it is necessary to have a base point or line and a suitable one seems to be the line passing through the point *E*, Fig. 3, of the angle made by the faces of the cutter. If the cutter intersects the blank, line *EF* will intersect the circumference of the toolblank. Taking any two sections such as *GH* and *IK* (Fig. 1) and finding the axial views, we see that the intersections occur at *L* and *M* respectively. The problem to solve now is the relation between sections *GH* and *IK*, due to the simultaneous rotation and advancement of the blank past the cutter. If the points *O* and *N* lie on the same spiral, it is necessary only to rotate the axial view of one section so that points *L* and *M* coincide. However, this condition





occurs for the whole layout only when the center A of the cutter lies above the center line of the blank B, as in Fig. 5 and then, theoretically, only at the section passing through A-5. In other words, a helix scribed on a round bar differs from the trace of a plane cutting the bar at the same angle as that of the helix.

For a study of reamer and cutter gashes the relation is sufficiently exact so that the difference between PQ and the spiral can be neglected. If N and O do not lie on the same spiral (and this can occur, particularly where the cutter and work are set at an angle which is not the helix angle), it is necessary to draw a true spiral through either point; for example N. Then find in the plan view the intersections of the sections with the spiral and with the line PQ of the cutter. The views are placed in Fig. 4 so that the points of intersection with the spiral coincide instead of the intersections with line PQ, as in the case shown. Then the two will be in the same relation as would occur in the cutting of the spiral gash on the milling machine.

If the procedure listed below is followed, the outline of a spiral gash can be generated graphically.

1. Select the angle of cutter most likely to suit.

2. Mark a point, A, on a perpendicular line.

3. Pass lines through A at the angles of the lip side and the land side of the cutter with the perpendicular. These represent the faces of the cutter. Lay in radius R.

4. Through any point O, draw a horizontal line.

5. And through O draw a line at an angle with the horizontal equal to the angle of the spiral.

6. From intersections C and D, draw perpendicular lines intersecting the line of the spiral angle at E and F.

7. With O as a center, swing arcs intersecting the horizontal at H and K.

8. Draw lines AH and AK and sketch in the radius. This will be the approximate shape of the cutter square with the tool blank. In reamer or cutter gashing where the proportion of the gashing cutter diameter engaged in the work is small, this approximation is permissible. Where considerable accuracy is necessary, as in the determination of a gear tooth profile, development of the cutter sections using descriptive geometry would be required. In a true section AH and AK (Fig. 6) would be curved lines.

9. Strike an arc with AB equal to half the diameter of the cutter as radius and the projection of the lowest point of radius R on AB as center.

10. On any horizontal line, lay off equal spaces, as IJ. From these, erect perpendiculars intersecting the arc just drawn as step No. 9. Then draw horizontal lines through these intersections, passing them through radius AB and marking them 0, 1, 2, 3 etc., with B as zero.

11. Cut out a template as shown by the heavy line.

12. Draw a circle with Z as center and of the diameter of the tool blank and to the same scale as the template made.

13. Erect a vertical diameter, letting the line extend some distance above the circle.

14. With Y as center, draw a semi-circle with YZ as radius. Through point I, draw a line at an angle with the vertical equal to the spiral angle. With I as center, strike an arc intersecting this line at J, using the spacing IJ as used in the template construction as radius. Drop a perpendicular from J intersecting the arc whose center is Y at X. Using this spacing IX, step off equal arcs on the arc whose center is Y. Now draw radii which, since the arcs are equal, will have equal angular spacing. The equal angular spacing represents the rotation of the tool blank.

15. Lay the template on the layout with line AB of the template on line IZ of the layout; this position will represent the greatest depth of cut. Mark the point where the zero point on the template falls on IZ. Through this point, draw a horizontal line VW.

16. Step off several points X, U, T, ...—using as spacing the projection of IX on VW. Using Z as center and ZV, ZT, ... as radii, mark points on YR, YR-1, YS, YS-1, ... *respectively*, and number these points 1, 2, 3 . . . . as the template is numbered. We now lay the template so that line AB lies along IZ and the points numbered 0 coincide and scribe the outline of the template on the layout. Proceeding thus with each point and position, the approximate outline of the cut will be obtained. The operation of locating points 1, 2, 3 . . . . can be shortened by locating any one point, preferably the fourth or fifth as explained, and passing a line through this point and the zero point. Draw the perpendicular bisector, letting it cross line O-Z. With this intersection as center, draw an arc through O. The intersections of the arc with R, S, ... will be points 1, 2, ... as before.

In the layout above described, where the zero point falls on IZ, the milling cutter was assumed to be set up with its center directly above the axis of the blank. The center of the cutter is assumed to be the point of intersection of the axis of the cutter with the line passing through the intersection of the lines representing the land and lip sides of the cutter, not the center of the radius at the point of the cutter. Bringing the center of the cutter toward the lip side produces more hook. This effect can be obtained by marking point 1 or 2 of the template on the line IZ as in No. 15 and then proceeding as above. If more hook is wanted, the zero point must be on the land side of AB; if less hook is wanted, the zero point should be on the lip side.

designing for efficiency

By Robert Mawson

Indexing Jig Fixture

ALTHOUGH SMALL DETAILS for special machines are usually considered unworthy of special jigs or fixtures, the Arrow Machine and Tool Co., Providence, R. I., has found that production methods can be used to machine many of the small parts for the special machines which they manufacture.

Typical of these is the jig fixture shown in Fig. 1. Made with a machine steel base, it is machined, then ground on top and bottom surfaces. An indexing plate is located to the base with a steel shouldered plug, made so that the plate is a good running fit. A center hole is drilled and reamed in the plug.

As shown in Fig. 1, accurately machined teeth provide 96 marked spaces on the plate. The indexing detail, made of a 5/16 in. shaft, moves through a hole in a steel bearing block fastened to the base with two Allen-type set screws. A tension spring, placed between the inner face of the block and the right face of the indexing detail, is moved in and out of contact with the indexing plate spaces by means of a steel pin driven into the upper surface of the indexing detail.

The plate is held during the machining operation with two steel clamps which are tightened with screws fitted with thumb-nut-type heads. Three nests of holes on the plate accommodate several sizes of workpieces. A clamp is provided for each nest, and at the outer end of each clamp is another Allen-type screw which can be adjusted to give the best holding position.

In operation, the workpiece is located on the plate and fastened with three clamps, adjusting Allen-type screws on the outer end of the clamps. If the workpiece has a center hole the locating pin in the center plug of the fixture, and spacer collars, if necessary, are arranged on the pin.

The 96 spaces on the fixture enable drilling of any number of holes which can be divided into 96: 2, 3, 4, etc. For example, if the workpiece requires drilling eight holes, the spacings are : 12, 24, 36, 48, 60, 72, 84, 96.

The indexing detail is then pulled out of contact with the indexing plate, using the pin in the block with the plate moved to position 12. The plate is fastened, the first hole drilled, clamps are released, the plate is moved to position 24, and the cycle is repeated.

To remove the finished workpiece it is necessary only to loosen the three holding clamps, swing them out of contact and the piece can be lifted out of the fixture. It can be seen that with the larger diameter of the indexing plate and therefore locating point, the holes drilled in the pieces, being smaller in diameter, are machined very accurately.

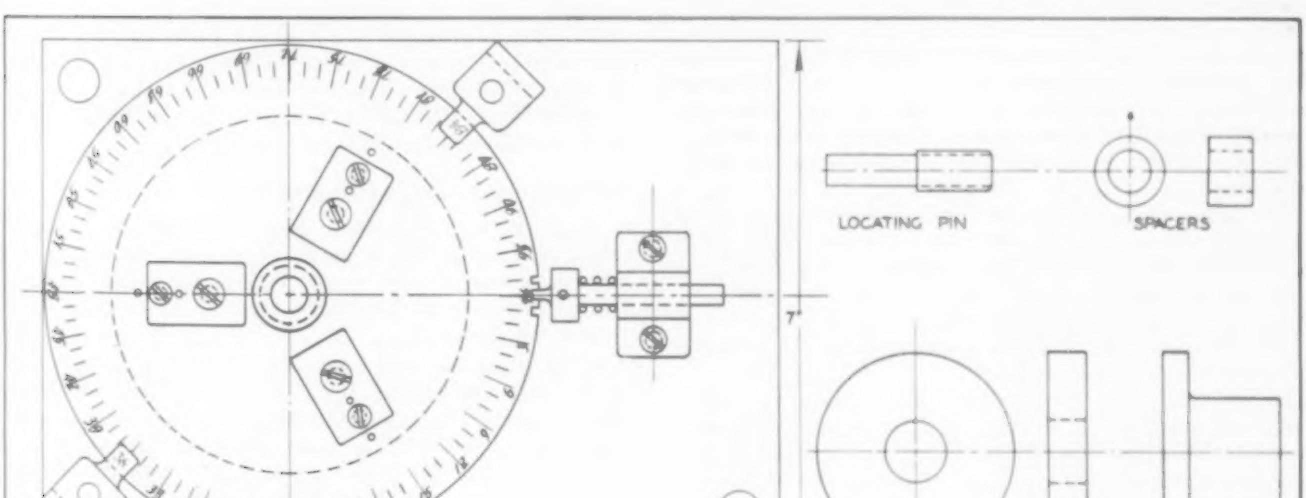


Fig. 1. An indexing jig fixture for accurately machining small parts

Design Economics

By John Van Hammersveld

SUPERVISOR OF DESIGN COST CONTROL
THE GLENN L. MARTIN COMPANY

Part I

DESIGN PROGRESSION USUALLY follows a general pattern of evolution to develop a product. Functional design aspects are the first consideration to determine the working relationships of the various parts and concepts of originations. Next, and directly aligned with the functional design, is the investigation of material requirements, specifications and costs to meet structural integrity. Following these progressions the phases of design and manufacturing producibility are surveyed in relation to the contract quantity. Finally, the incorporation of tooling requirements, types and procedures aligned with manufacturing methods are achieved.

This sequence shows the specific design breakdown portraying the relationship of each stage. In other words, this implies that design evolution is a complete cycle, all points being united together as one basic problem. To maintain design and manufacturing efficiency in today's competitive market, it is essential that the complete *design progression* cycle be recognized and fulfilled.

Examination of the functional aspects of design indicates that these are inherent qualities that a designer possesses from his natural aptitude for engineering and his educational background. However, the aspects of design and manufacturing producibility are not inherent but are phases of design that need constant investigation, development and application since these are the basic fundamentals for achieving low cost products.

Now the question arises, "What can be done to provide the engineer with the tools (used in a broad sense) necessary to achieve maximum efficiency in design evolution?"

The Glenn L. Martin Company has been actively engaged for a number of years in a development program to find ways and means to effectively step up the efficiency of designing to acquire economical production in a similar manner as the manufacturing personnel has always been supplied with the most efficient tooling procedures, process techniques, and equipment.

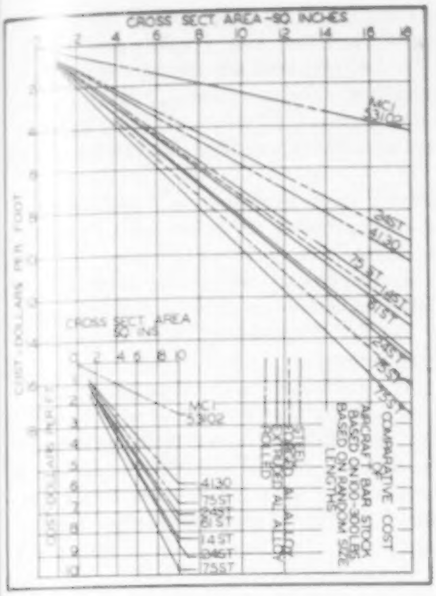
One of the first steps in this effort to provide the tools was the development of design information in bulletin form; a basic function of the Design Cost Control Group. This information is prepared in a concise form to quickly supply the engineers with the most pertinent design economics. There are three basic types of bulletin information: Comparative Cost of Materials, Comparative Cost of Standard Parts, and Design for Economy.

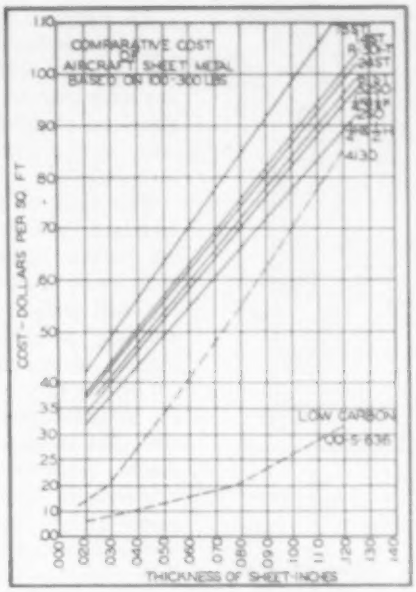
Comparative Cost of Materials

This bulletin contains cost data on all metallic materials used in the fabrication of parts. It covers a range of material types such as: bar stock, tubing, extrusions, castings and forgings, in all commonly used alloys of aluminum, steel and magnesium.

All material cost data are shown in useful graphical form to facilitate the ease of obtaining and show the engineer the comparative costs of each kind of material under each basic type. For bar stock, sheet metal, aircraft tubing and aluminum extrusion (Figs. 1, 2 and 3) a premise of 100-300 lb. is established as the normal purchased quantity of material to show the comparative cost relationships. From statistical material pricing data the curve plots are evaluated, using the most feasible methods of presentation such as: for bar stock, cross-section area vs. cost per linear foot; sheet metal, gage thickness versus cost per square foot; tubing, diameter and wall thickness vs. cost per linear foot. Extrusion costs are estimated on a cost per pound basis.

The exact cost per pound can be easily interpolated by developing the correct form factor for the desired extruded shape which is the cross-section perimeter divided by the cross-sectional area multiplied by 1.2. This factor, when





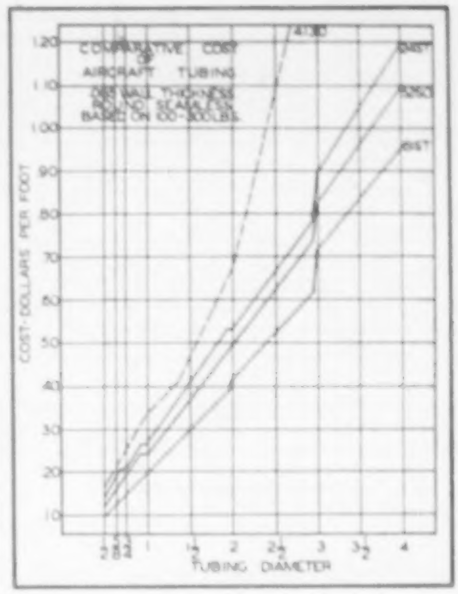


Fig. 1. (left) Aircraft bar stock material cost. Fig. 2. (center). Aircraft sheetmetal material cost. Fig. 3. (right). Extrusion material cost.

applied to the current price table, gives the basic cost per pound. Also included is the die cost information which is based on the size of the circle which will circumscribe the cross section of the extrusion in question.

The forging and casting cost data (Figs. 4, 5, 6 and 7) required considerable investigation and development to achieve comparable bases of presentation. A classification premise as shown in Fig. 8 evolved into definitions of simple, average and complicated classes to provide the engineer with an efficient means of obtaining accurate cost data for his selections. Also, a quantity premise of 100 pieces, established as a maximum purchase quantity, set the bases for the development of the curve plots.

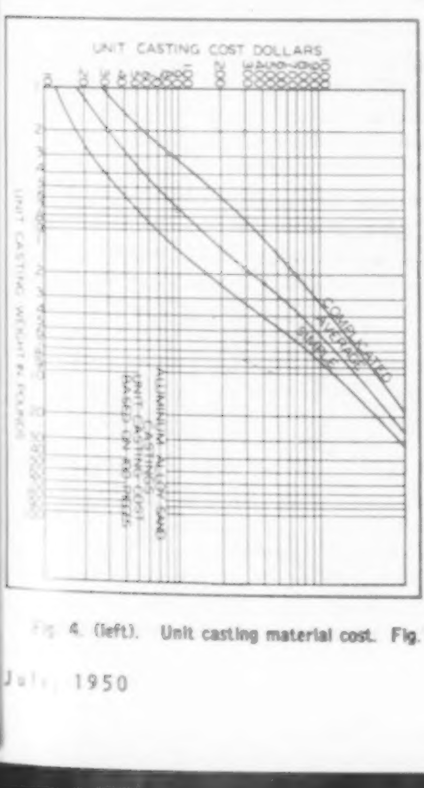
To obtain the statistical data for the development of the curves, a card index file system coordinated with the purchase order receipts provided a continuous flow of up-to-date cost information. Fig. 9 illustrates a typical type file card and purchase order showing the breakdown of the cost data. Also, a file drawing of each part is maintained and used for classifying as well as obtaining weight information for the X ordinate in plotting the curves.

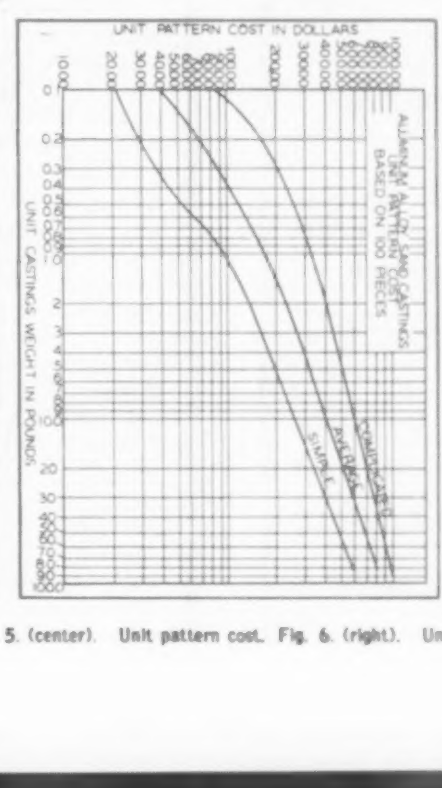
The use of the weight bases to determine the per-piece prices and pattern or forging die cost proved to be very effective since the drawings of the parts are released with the estimated weights. This is a procedure prevalent in the aircraft industry.

The engineer in the early stages of design is often confronted with the problem of when and when not to specify a new extrusion and die; reorder an existing extrusion; use standard stocked extrusion and machined off legs, or produce the shaped part from machined bar stock.

Extruded material is widely used in aircraft design because of its excellent structural applications and ease of fabrication. To aid the engineer in determining the proper decision, a typical set of cost data as shown in Fig. 10 solves many of his problems.

This series of curves shows the cost of structural angles in terms of production methods and number of feet per production run. To prepare these curves, the following steps were taken. First, from previous purchase records, a list of frequently used angles was drawn up. By listing angle dimensions it is found that, by grouping, they fall into various





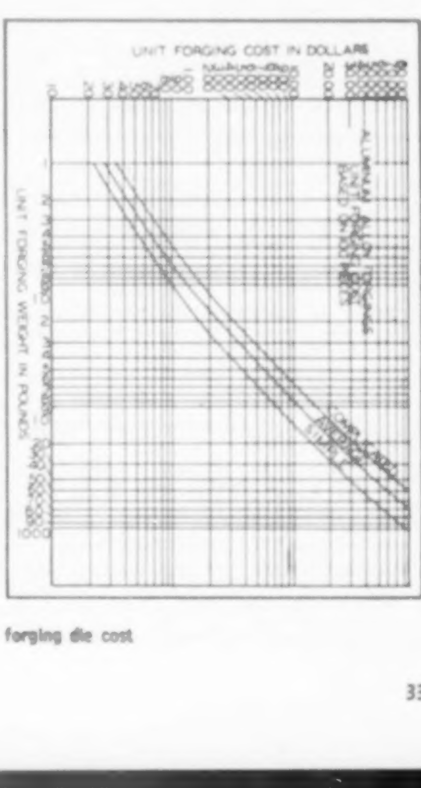


Fig. 4. (left). Unit casting material cost. Fig. 5. (center). Unit pattern cost. Fig. 6. (right). Unit forging die cost

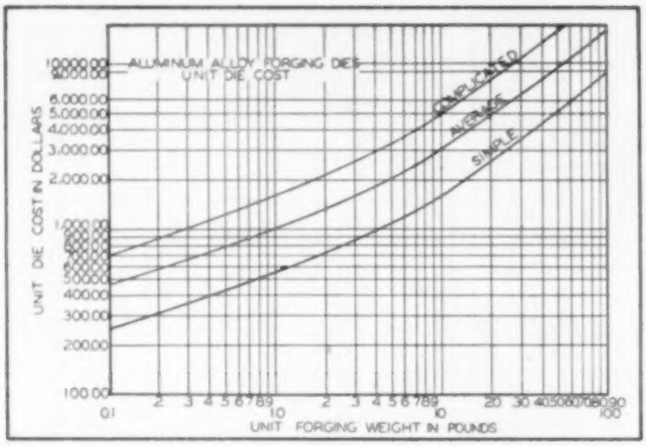


Fig. 7. Unit forging material cost.

diameter-circumscribed circles. Second, by selecting the average size within the circle diameter, the basis for determining comparative production costs can be developed. As indicated in Fig. 10 crossover points show when certain methods of extrusion procedures pay for themselves, depending upon the quantity required.

Material cost data given in the bulletin can be used easily. After the designer has established a satisfactory functional design, he determines the amount of material needed to manufacture the design. Using the material cost tables and charts, he selects the most economical material to use, depending on his judgment of the design factors involved.

Comparative Costs of Standard Parts

The second bulletin lists cost of standard parts such as: rivets, bolts, screws, and fasteners. Almost every manufacturing company uses standard parts in the fabrication of a product and, of these, there are many sizes and types. Usually the installed cost of a standard part, rather than the initial cost, determines whether or not it can be used. To facilitate presenting this information for the engineer's use, it is organized into two main divisions:

Part 1—Installed cost of standard parts used in the general applications of structural designs.

Part 2—Installed cost of standard parts used in general applications of nonstructural designs.

FIG. 8—CLASSIFICATION OF PROCESSES

CASTINGS

SIMPLE: (1) Impression in one half of the mold. (2) No coring.

AVERAGE: (1) Impression in one half of the mold plus simple coring. (2) Impression in both halves but no coring.

COMPLICATED: (1) Impression in both halves of the mold plus intricate coring.

NOTE: In quantities of less than 100 pieces the pattern equipment is usually "loose wood" of pine or mahogany material and runs approximately 40 to 60 percent of permanent metal equipment.

FORGINGS

SIMPLE: (1) Impression in one half of the die. (2) Parting planes are straight.

AVERAGE: (1) Impression in both halves with straight forward die sinking. (2) Parting planes are straight.

COMPLICATED: (1) Impression in both halves of the die plus complicated or curved die faces of wrapped parting planes. (2) Deep impression to fill. (3) Multiple blocking dies necessary.

GENERAL NOTES: Die costs remain constant for any quantity of pieces. The unit price is subject to change for low quantities. Die setup charges approximately 10 percent of die cost.

All standard parts are listed by their specific commercial or AN standard name, number, size, length, grip, weight and installed cost. In the total cost are the cost of the part, the labor cost for handling, drilling, reaming, countersinking, dimpling, riveting, de-burring, tightening, checking by operator, and all other operations required to complete the installations.

The time to perform each operation is evaluated from standard time data and converted to dollar costs by applying proper fatigue allowances, take-away rates, learning cycle curve factors and overhead rates. The material cost for each standard part is based on general bulk shipment normally procured by the Purchasing Department for a number of production orders.

Comparing the cost of similar standard parts, as shown for a typical page in Fig. 11, the designer is able to select the most economical standard which meets design requirements. His selection sets the cost of installation. Shown in this bulletin are installed cost data for Hi-shear rivets compared with bolts, blind rivets compared with regular types, Airloc fasteners compared with anchor nuts, and many other combinations of standard parts.

Design for Economy

The Design for Economy bulletin is comprised of over 125 classified fitting summary sheets as typically shown in Fig. 12. This type of presentation shows the designer the aspects of manufacturing and tooling cost on the type of material selection for the quantity of fittings under consideration.

As a series of historical references of fitting designs, these summary sheets are of great value to the designer. Using these references for comparing similar shape, size and weight to a newly-designed fitting will enable the designer to make a design decision with a fair degree of accuracy.

Fig. 9. Card file to purchase order for casting and forging data.

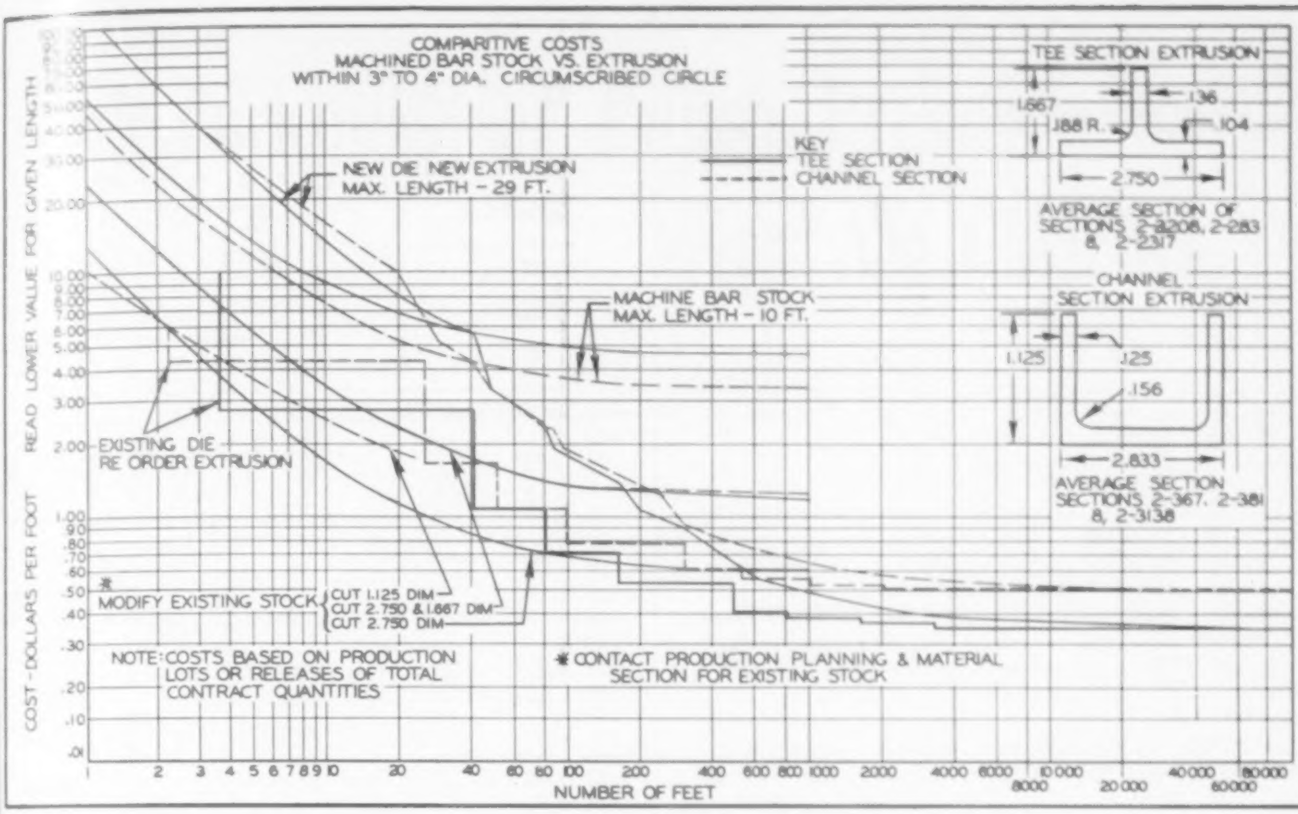


Fig. 10. Comparative extrusion and machined bar stock costs.

The procedure followed in obtaining the data itemized in Fig. 12 is typical of the coordinated efforts of the designer and Design Cost Control engineer in reaching the correct decision. Four methods of fabricating this fitting are analyzed to determine the most economical method of manufacture for the types of material selected: (1) 24S-T machined bar stock, (2) 14S-T machined forging, (3) 4130 welded steel, and (4) machined aluminum alloy casting.

Premise is set for a quantity of 100 parts, with shop lot releases set at 25 parts. This premise, as in any cost investigation, is of vital importance since the quantity of parts to be made has a direct bearing on the method of manufacturing.

In Fig. 13 is shown the breakdown of costs of material, fixed tools, set-up labor, dies and patterns to fabricate the fitting by each of the four methods being studied.

The first step in the analysis is to develop material costs. The unit material and forging die or pattern costs for each application is readily obtained from the charts in the bulletin "Comparative Costs of Material" as shown in Figs. 1, 2, 4, 5, 6, 7 and 8.

The next step in the analysis is to develop the manufacturing cost by means of an elemental breakdown of setup and labor time in machining or fabricating each design (Fig. 13. To develop these elemental breakdowns requires an experienced man who knows all types of machines in the shop as well as the techniques used in producing a part from these machines. The design cost control engineer in the various projects has the knowledge and techniques to analyze these fittings as to their elemental breakdown.

The time value for each operation is evaluated from standard data books compiled by the cost control group. Adding the elemental time values for both setup and run-time establishes the total operation time sequence. Normally this total in minutes is changed to hour values for conversion to dollar-costs.

Fig. 11. Standard parts—rivet cost comparisons.

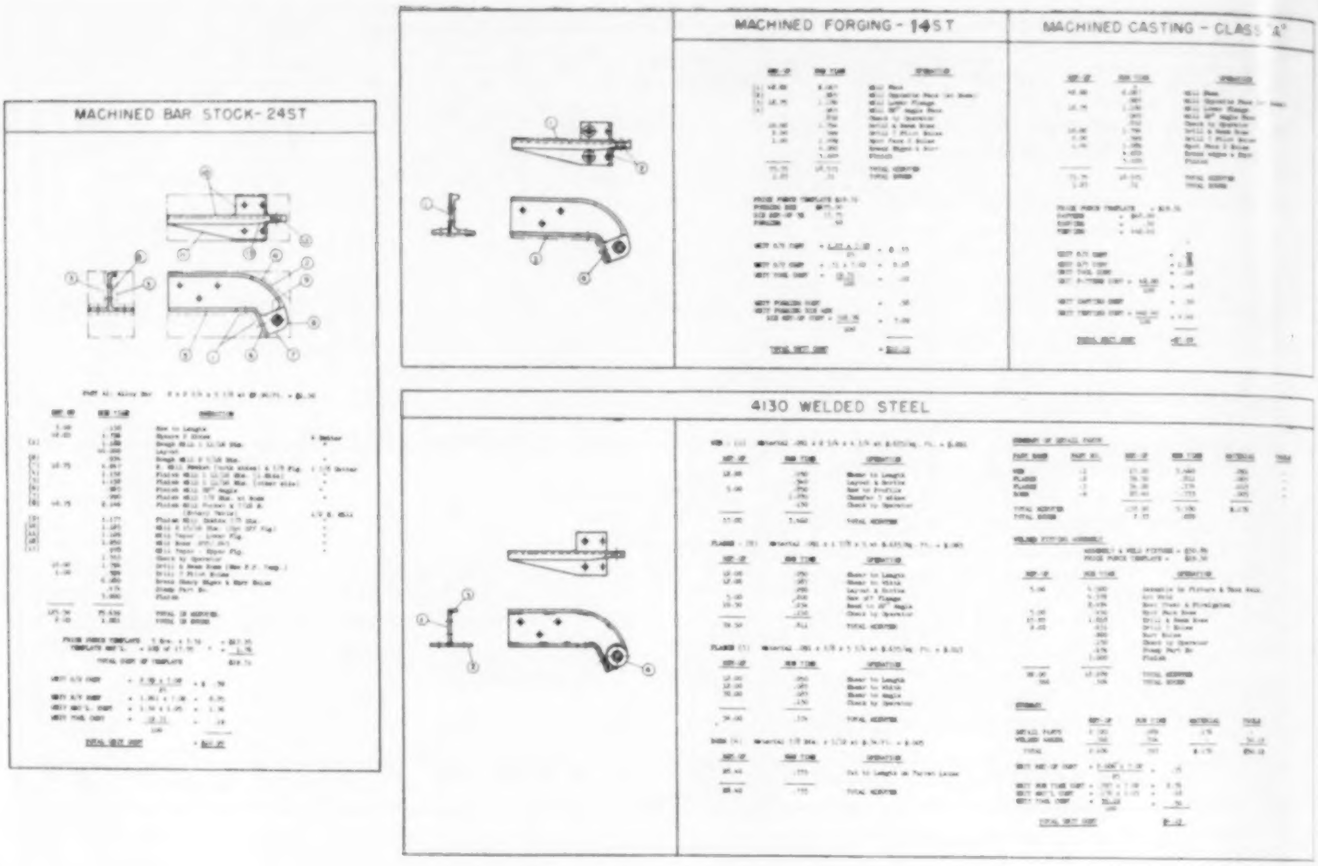
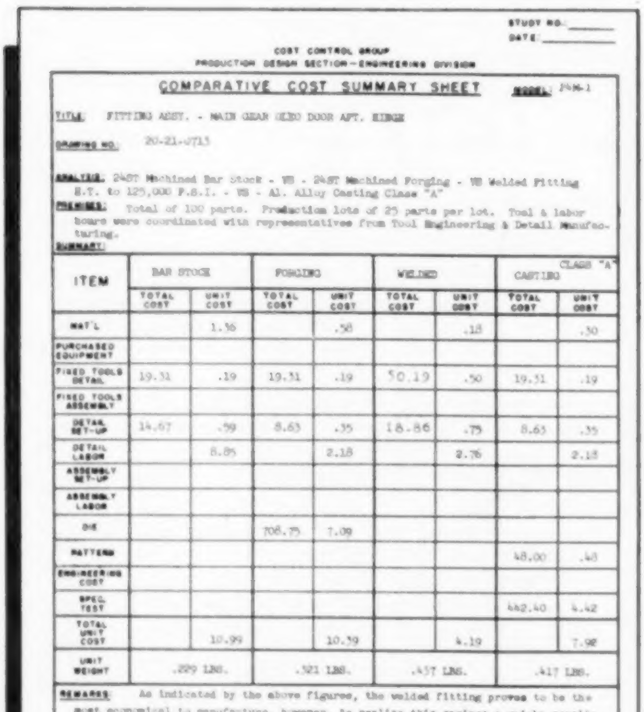


Fig. 12. Fitting summary sheet—door aft hinge.

Fig. 13. Fittings cost breakdown evaluation.



STUDY NO.______

DATE______

COST CONTROL GROUP
PRODUCTION DESIGN SECTION—ENGINEERING DIVISION

COMPARATIVE COST SUMMARY SHEET — MODEL: [illegible]

TITLE: FITTING ASSY. - MAIN GEAR [illegible] DOOR AFT. HINGE

DRAWING NO.: 20-21-0713

ANALYSIS: 24ST Machined Bar Stock - [illegible] - 24ST Machined Forging - [illegible] Welded Fitting H.T. to 125,000 P.S.I. - [illegible] - Al. Alloy Casting Class "A"

PREMISES: Total of 100 parts. Production lots of 25 parts per lot. Tool & labor hours were coordinated with representatives from Tool Engineering & Detail Manufacturing.

SUMMARY:

ITEM	BAR STOCK		FORGING		WELDED		CLASS "A" CASTING	
	TOTAL COST	UNIT COST	TOTAL COST	UNIT COST	TOTAL COST	UNIT COST	TOTAL COST	UNIT COST
MAT'L		1.36		.58		.18		.30
PURCHASED EQUIPMENT								
FIXED TOOLS DETAIL	19.31	.19	19.31	.19	50.19	.50	19.31	.19
FIXED TOOLS ASSEMBLY								
DETAIL SET-UP	14.67	.59	8.63	.35	18.86	.75	8.63	.35
DETAIL LABOR		8.85		2.18		2.76		2.18
ASSEMBLY SET-UP								
ASSEMBLY LABOR								
DIE			708.75	7.09				
PATTERN							48.00	.48
ENGINEERING COST								
SPEC. TEST							442.40	4.42
TOTAL UNIT COST		10.99		10.39		4.19		7.92
UNIT WEIGHT	.229 LBS.		.321 LBS.		.437 LBS.		.417 LBS.	

REMARKS: As indicated by the above figures, the welded fitting proves to be the most economical to manufacture, however, to realize this savings a weight penalty of .208 LBS/PART would have to be accepted.

ACCEPTANCE OF COST DESIGN DECISION: ______ DATE: ______

PREPARED: ______ DATE: ______ APPROVED: ______

The evaluation of the dollar-cost conversion factor requires the incorporation of cost accounting data for rework and rejection allowances, direct labor immediate supervision adjustment factor, and average departmental efficiency percentage. Then by applying the average direct labor rate and burden percentage, the complete dollar-hour conversion factor is evolved. This figure, when multiplied by the amortized setup and total run times in hours, will give the final dollar cost of fabrication.

After the material and fabrication cost of each fitting is determined, the next step is the consideration of the tooling cost to complete the total cost evaluation. The fixed tools necessary to complete the fabrication are composed of a prick-punch template for locating the attachment holes, and a welding fixture. All four fitting designs require the prick-punch template with only the welded design requiring the additional welding fixture. The type of tools and manufacturing hours to build them are coordinated with the Class "A" casting, since this casting is classified as a structural fitting. The testing cost is amortized over the quantities of purchased casting. This testing cost is composed of structural engineering and laboratory costs.

Combining the material, fabrication and testing cost gives the total unit manufacturing cost for each fitting: $10.99 bar stock; $10.39 forging; $4.19 welded and $7.92 casting.

The weldment proved to be the most economical for the quantity of parts under investigation. A critical review of this typical cost breakdown, Fig. 12, for each method of fabrication enables the engineer to determine why certain designs are more costly than others so that he can take the necessary steps to modify the design to facilitate economical production.

Knockouts for Punch Presses With Air Clutches

By A. C. Good
NATIONAL CASH REGISTER COMPANY
DAYTON, OHIO

THE USE OF AIR clutches on punch presses has brought about some interesting developments in the use of knockout bars for tap ejection. Pressure pads or air cylinders strip blanks out of compound or inverted type dies, piercing and shaving or blank and piercing dies.

Heretofore the conventional type of positive knockout commonly used on presses equipped with mechanical type clutch was a solid bar (see *B*, Fig. 1) pivoted at the back of the ram (on smaller presses) and projecting through a slot resting on a steel plug or knockout pin *E*. This in turn rested on top of the die set, covering the pressure pins used to transfer the knockout pressure to shedder or stripper. The bar rises in operation of the press when the operation is performed. With the crank at top center it is returned to its original position by contracting screw *D* mounted in bar *C*, and attached firmly to uprights of the press. This action will shed the blank from the die through the medium of pressure pins or plug mentioned above.

With a mechanical clutch such a knockout works very well. No particular trouble has been experienced with it. But when we switched to an air clutch on our punch presses, trouble began. With a mechanical clutch the ram would stop at top center without any trouble regardless of any resistance set up by the knockout bar as shown in Fig. 1. With the air clutch the air is turned off and a spring brake takes over at a point on the ram's ascent so that the ram will stop somewhere close to the top of the stroke with no resistance on the knockout bar.

This resistance, which varies depending on the size of the job being run in the press, causes the ram to stop behind center or coast too far past to permit a good loading condition in the die. If screw *D* in Fig. 1 is adjusted down to shed all blanks the ram will invariably stop behind center, so when the press is tripped again the crank must go up over center, springing bar *C* and causing frequent repairs and constant adjusting of the cam controlling the air clutch.

To overcome this difficulty we installed the following version of a positive knockout with very satisfactory results (see Fig. 2). When the press is at rest, the ram is in "up" position. The press is tripped, the ram travels down, performing the operation and picking up the blank with the die. This causes *D* to pivot on pin *H* and in clearance cut on cam block *B*. When on the upstroke *D* strikes the angle on cam block *B* and is forced back, causing pressure on *E* which in turn will shed out of die. Screw *C* must be long enough to allow for adjustment of the ram on a punch press. This type of knockout allows greater flexibility inasmuch as the blank can be shed any time after the ram has started up.

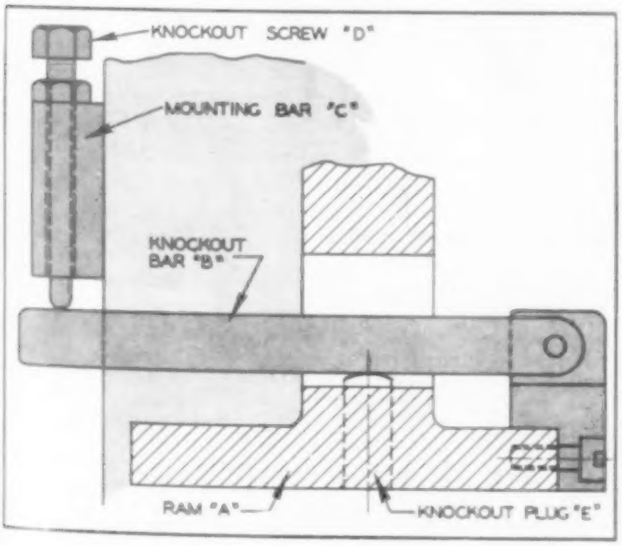


Fig. 1. Press ram in down or 'home' position.

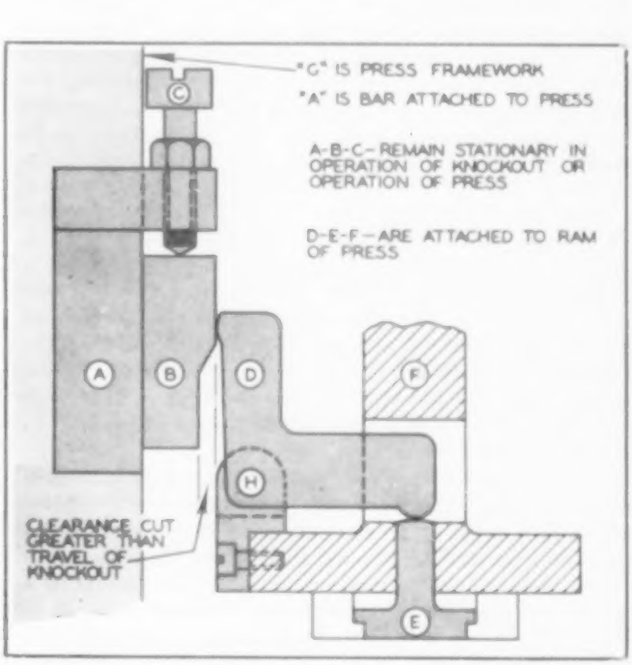


Fig. 2. Positive knockout as installed on the press.

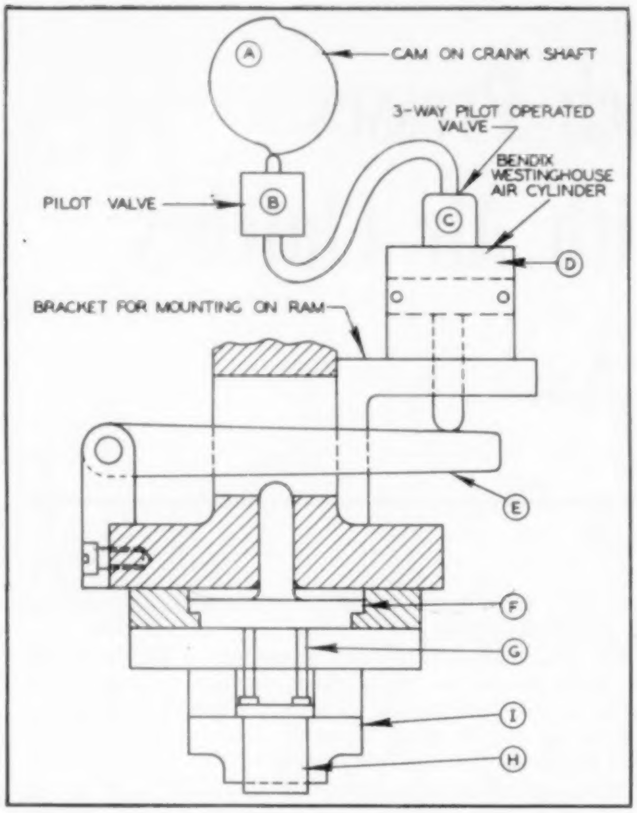


Fig. 3. In this arrangement pressure is available on the work to hold it flat while operation is being performed, yet blank can be retained in die while rising to top of stroke.

Figs. 1 and 2 illustrate two versions of the positive knockout. In these there is no pressure applied on the work when the operation is being performed except at the top of the stroke when the blank is in the process of being knocked out of the die. Sometimes it is desirable to have pressure on the work to hold it flat while the operation is being performed, yet be able to retain the blank in the die and carry it up to the top of the stroke before shedding or stripping it to be blown out in the conventional way. This is shown in Fig. 3.

Here pressure is kept on the blank in a compound die until the operation has been performed. Then the pressure is cut off at the bottom of the stroke, carrying the blank to the top of the stroke, where air comes on, shedding the blank as in the use of the positive knockout bar. Operation is as follows: the press is at rest, with air pressure on in cylinder *D*. The press is tripped, the ram travels down, performing the operation. At the bottom of the stroke, knockout bar *E* has been raised through pressure of operation through *H*, *G* and *F*. When the blank has entered *I*, cam *A* is so made and located on crank of press that air in cylinder *D* is dumped quickly through pilot valve *B* and three-way valve *C*. Air remains off until the ram has reached a position near the top of the stroke. At this point cam *A* is designed to cause air to again enter cylinder *D* ejecting the blank as with the positive knockout bar. (This cycle has been used to stamp identification marks on parts by putting a stamp in *H*).

It is sometimes desirable to stamp some sort of identification on the blank. This can easily be accomplished by adding a stamp in *H* stop blocks, or a soft insert in the part directly under the stamp. The pressure required to eject the blank is more than enough to make a readable indentation on a piece of punching steel. (It takes approximately 1000 lb of pressure to make a readable impression in a piece of stock using a figure or letter 1/8 in. high. An additional 1000 lb should be allowed for each additional character or letter).

There are times when it will be desirable to keep pressure on the blank all the time. Such an instance might occur in using this type of knockout on open pierce or shave dies where the blank is to be left on the die for a future pick-off operation. This is accomplished by installing valves in such a position as to bypass controls which cut off air at the bottom of the stroke. This is merely a piping problem.

Adoption of this knockout system brought about a condition which can become a serious problem. Where air is used, it does have a tendency to build up pressure. Then when the blank breaks loose or starts to move, the whole mass will shoot downward and may cause damage to delicate die parts. This can be readily overcome with an oil dash pot shown in Fig. 4.

This hydraulic check or dash pot carries the weight of the knockout bars and Marquette cylinders and prevents damage to the die when used for the knockout in place of a positive knockout, using screws as in common practice. Unit *A* must be placed under each end of the knockout bar (4 in all). The psi in unit *A* may be rather high, but psi in unit *B* need not be any greater than necessary to carry the weight of the Marquette cylinders and knockout bars.

In closing this article on punch press knockouts, the following suggestions are offered, which may be helpful in the design and development of the air cylinder and subsequent oil dash pot and its construction. Fittings, flow control valve, etc. must be strong enough to withstand the necessary pressure exerted by the air cylinder. However, as mentioned above, pressure in unit *B* (Fig. 4) need only to be high enough to carry the weight of the air cylinder and knockout bar.

This will work equally well on any press regardless of the number or position of knockout bars. Design can be altered to suit each individual condition and although the dash pot must be under the bar, the air cylinder or Unit *B* (Fig. 4) can be mounted on the framework of the press if necessary, using a flexible high pressure hose connected to the dash pot. A hole of the proper size may be used instead of the adjustable flow control valve shown. This will give the same speed of recovery to the dash pot as speed of action and might be less apt to leak under the high pressure or oil surge at the time of action on the knockout bar.

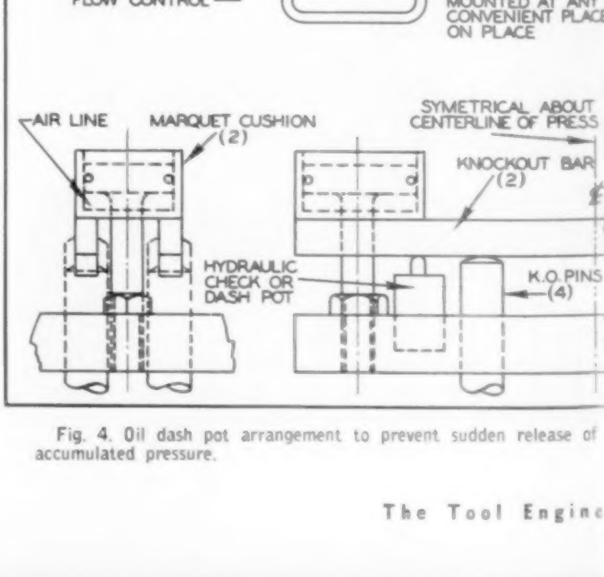


Fig. 4. Oil dash pot arrangement to prevent sudden release of accumulated pressure.

Designing Inspection Fixtures and Tools

By W. H. Barling
PROCESS ENGINEER
CONSOLIDATED VULTEE AIRCRAFT CORP.

There is a major difference between inspection tools and fixtures and regular production tools. Production tools for small volume are sometimes coordinated with others, in which case the parts could fit closely even though both are outside of drawing tolerances. In this case the inspection department inspects to the proofed production tools. However, for mass production, and especially if the purchasing department may order parts made by outside companies, who do not have tools coordinateed with the production tools of the home plant, there must be a standard set forth on paper. This standard is the engineer's blueprint.

In any case the inspection department cannot refuse to pass a part which agrees with the drawing, if inside of drawing tolerances, whether those parts be made in the factory or outside. This general case of mass production is considered below.

Justification of Expense

Consider an inspection tool consisting of two separate units a "Go" tool and a "No Go" tool. The tolerance of manufacture of each of these tools is perhaps one-tenth of the tolerance on the production drawing. Since this procedure involves two tools, each made far more accurately than are production tools, we immediately have an expensive outlook.

We must consider how to keep this expense down.

We use the following principles for this purpose:

1. Make one tool only - a "Go" tool - and use feelers to check that the part does not fit the tool too loosely.
2. Check only the fewest possible points on the job—significant points only. Ignore the majority of the part. Two points fix a plane part, and three points fix a volume part.

NOTE: **A fundamental difference between production and inspection tools is that the production tools have the purpose of making a part of dimensions somewhere within engineering drawing tolerances. On the other hand inspection tools must accept parts anywhere within the drawing tolerances, without preference.**

The fundamental purposes of inspection tools are to reduce the time required for inspection, or to permit the use of employees of less skill to properly inspect parts. About 400 special inspection tools are economically proper for a four-engined bomber.

3. Separate the subject of space dimensions, and the diameters, etc., of individual holes. Then use pins, undersized in diameter by twice the tolerance on the space dimensions of the center of the hole.
An alternative to this is to use pins of (minimum) drawing size to fit in holes, the pins to be located by an oversized hole in the wall of the inspection fixture.
4. It may be noted that the diameter of the holes should be separately checked by "Go" and "No Go" plug gages (preferably made in one piece to decrease chance of losing).
5. For overall lengths or contours, make the edges of the fixture (such as its base), the exact nominal overall dimension, and use the inspector's eyes or fingers to detect the absence of conformity of the part of this edge. Check, when needed, by straight edge and feeler.
6. Consider designing the tool so that LH and RH parts can be inspected by one fixture. We may extend this principle to the case where one inspection tool can be used for several different parts, by slight additions to the tool.
This principle often does not pay; for example, if the result is nothing but the addition to one oversized base of many separate tools which could have been built at no more cost on separate bases. As production increases, the division of the tools enables the inspection department to have additional personnel working efficiently on the separate items.
7. Obviously, elaborate metal fixtures cannot be justified in general to inspect parts where the dimensions can be readily measured by simple gages of the "Go" and "No Go" variety.
8. The justification of the cost of inspection tools increases proportionally with (a) the number of parts used per airplane, (b) the number of types on which these parts are used, (c) the difficulty of measurement due to three dimensional effect, compound angles on drawings, etc., (d) the small size of the part.
9. For some welded assemblies or tube assemblies or castings, we may use wood fixtures, made so that a tool-proofed sample of least acceptable size will fit loosely. Here the looseness is the amount of the total drawing tolerance. Direct steel rule measurement between fixture and part is used for inspection.
For the purpose of inspection, the part should be merely placed into such wood inspection fixtures, and

the wear should not be too great. There must be no forcing; no reworking of parts in these inspection tools.

Electric Wire Assembly Boards

These are quite different from the other inspection fixtures, since they are in fact production tools. However, by adding checkout wires on the backs of these, a single inspector can quickly inspect the work, and the production department can find its own errors quickly too, prior to calling the inspector. This cuts man hours to 20 percent for inspection costs.

These additions pay for themselves in less that 20 ships, in man-hour savings directly. The old method required a man at each end of the assembly board, one with a battery the other with a meter. The newer method requires only one inspector at one end with battery and meter.

Ordering and Checking Inspection Tools

(a) On machine shop parts the inspection fixture should be designed to check the holes before the bushings, etc., are pressed in. The inspection fixture should be so shown on the operation sheet.

(b) Inspection tools should bear the word "Inspection" in their title. The word "Checking" is reserved for tools used by production departments. The inspection department tools are kept either in special inspection tool warehouses, or by each supervisor of inspection in lockable cabinets.

(c) The detail to be inspected should be supported from the significant points which the tools inspect, and free from contact elsewhere. Thus any local imperfection at an unimportant point will not stop the inspector from putting the casting or forging (or other part) in the "Go" gage.

(d) Inconvenient, awkward tools do not encourage their own use. Heavy inspection fixtures should be fastened to a movable table.

(e) Etch lines on the tool are useful to show location limits. The feature inspected must lie between the two etch lines. Examples: hole edges on profile gages, location of cross pins on plug gages.

Tolerances For Inspection Tool Manufacture

The cost of any inspection tool depends on four factors: (a) general design; (b) the material; (c) general machining of those parts requiring no particular accuracy; (d) the finish, and accurate sizing, of these tool parts which require accuracy.

Table I - Inspection Tool Drawing Tolerances

Column 1 Production Articles. Largest permissible size—Smallest permissible size.	Column 2 Inspection Tools Tolerance, plus and minus to be put on inspection tool drawing.
Less than .003	Special study of case required.
.003 to .004	.0005
.004 to .008	.0007
.008 to .012	.0011
.012 to .020	.0015
.020 to .040	.0022
.040 to .100	.0035

Of all these factors, (d) is often the most important. Therefore, the tolerances on the inspection tool drawing must be kept as large as possible. But theoretically no tolerance is permissible in the inspection tool. A rule must be arbitrarily set up such as shown in Table I.

Any tolerances on the inspection tool drawing dimensions are really tolerances on tolerances, and often lead to expensive figures. On the other hand, any tolerance may reject good articles, within engineering drawings, or accept articles outside the engineering tolerance.

Applying Tool Drawing Tolerances

First find the largest permissible size and the smallest permissible size of the production parts to be inspected as given by the drawings. This is Column 1 in Table I.

(a) Blue print of a part calls for 0.500 + 0.0004, — 0.006. Here the part will be usable if it lies between 0.504 and 0.494. The manufacturing total tolerance is thus 0.504 — 0.494 = 0.010.
The inspection tool drawing tolerance is ± 0.0011 (as found from Table I).

(b) Blue print dimension 0.500 + 0.002, + 0.008. Usable sizes are 0.508 and 0.502. Manufacturing total tolerance = 0.508 — 0.502 = 0.006, corresponding to which, the table shows an inspection tool tolerance of ± 0.0007.

(c) When the tolerance on the inspection tool runs to four decimal places, then the nominal dimensions on inspection tool must be given to four decimal places.

(d) For an "encased" Go gage, make gage about 0.0004 in. small, since a solid 1 in. plug will not enter a 1 in. ring.

Chapter Membership and Education Committee Chairmen:

For a limited time, The Tool Engineer will make available, postage prepaid and free of charge, copies of the papers listed below which were presented before ASTE's Annual Meeting in Philadelphia, April 10-14. These papers, which are surplus printing forms, will be mailed on request in any quantity as long as the supply holds out. They are stitched as a forty-five page unit; we cannot mail individual papers.

Available papers include:

Forming Sheetmetal by the Marform Process
By R. B. Schulze

Design and Use of Die Casting Dies
By Charles Franklin

The Mechanization of Parts Handling
By C. E. Kraus

Effect of American Standards on Lathe Spindle Deflections
By Dr. M. Kronenberg

Automation in the Pressroom
By Herman Zorn

Industrial Applications of Metamics
By W. O. Sweeny

Design Economics
By John VanHammersveld

The Technique of Micro-Drilling
By J. A. Cupler

Applications of Drill Units to Standard and Special Machinery
By Eugene Numrich

Use of Time Element Data for Effective Tool Design
By N. M. Perris and H. K. Keever

Please address your request to The Tool Engineer, stating the number of sets desired, and the address to which they should be shipped. If demand exceeds supply, we will endeavor to insure a reasonable quantity to all chapters requesting papers.

JIC Electrical Standards for Industrial Equipment

E0.1 The purpose of these standards is to provide detailed specifications for the application of electrical apparatus to industrial equipment which will promote safety to personnel, uninterrupted production, long life of the equipment, and is not intended to limit or control development in the art of electrical or mechanical engineering.

E0.2 When purchaser requires electrical equipment to conform to JIC Standards he shall so specify in his original inquiry and on his purchase order.

E0.3 The purchaser will specify such additional details as are required to meet his local requirements, such as motor and control desired, electrical power supply available, provisions for unusual conditions, etc.

E0.4 When requested on purchase order, the industrial equipment builder shall submit for purchaser's approval preliminary data consisting of:

(a) 1. Elementary diagram
2. Electrical stock list
3. Sequence of operations
4. Electrical layout

(b) This shall be done before electrical equipment is installed. After preliminary approval by purchaser any deviation by equipment builder shall have purchaser's approval. Prints, as described above, shall be submitted in quantity as called for on purchase order. Wiring diagrams shall be furnished with the equipment when shipped.

(c) One vandyke or equal and two copies of final diagrams as described above, shall be forwarded to purchaser by mail not later than date on which the equipment is shipped. These diagrams shall be identified with purchase order number and serial number of equipment or if none with a full description which will identify the diagrams with the particular equipment.

E0.5 A nameplate, listing voltage, phase, frequency, full load current or rated kva, control circuit voltage and wiring diagram number shall be attached to the control equipment or machine.

E0.6 On any point for which specific provisions are not made in these specifications, the provisions of the National Electrical Code shall be observed. Article 670 of the Code applies specifically to machine tools. Article 630 of the Code applies specifically to welders.

E0.7 Wherever a specific standard is mentioned, it is understood it will be "the latest revision thereof", unless otherwise specified.

E0.8 Deviations from these Standards shall have purchaser's approval in writing.

E1 DIAGRAMS

E1.1—Single Motor Equipment

E1.1.1 On machines having only one motor and one starter, the wiring diagram normally furnished with the starter shall be considered satisfactory, provided the diagram shows all of the electrical equipment on the machine.

E1.2—All Industrial Equipment Not Covered by E1.1

E1.2.1 Where more than one motor, starter, or auxiliary device is used (if the motors and controls are not entirely independent) Paragraph E0.4 shall apply.

E1.2.2 The wiring diagram, elementary diagram, electrical stock list and sequence of operations when practicable should be shown on the same sheet. All sheets to be 8½ in. x 11 in., file size or whole multiples thereof. Drawings shall be of such size that all information is clearly legible.

E1.2.3 A copy of each diagram shall be firmly attached to the inside cover of electrical enclosure either by adhesive material or by permanent data pocket or clip.

E1.3—Wiring Diagram

E1.3.1 The wiring diagram shall show the general physical layout of electrical control panel with all relays, disconnect switch, control transformer, terminal strips with numbers, etc. Interconnection diagrams should be shown as part of wiring diagrams. Detailed dimensions need not be shown. All control devices in the control panel and external to the control panel shall be identified as required in paragraph E6.2.1.

E1.4—Elementary Diagram

E1.4.1 The elementary diagram shall be drawn with vertical lines to represent the source of control power and all control devices shall be shown between these lines making use of standard symbols. Electronic diagrams may be drawn between horizontal lines. Control transformers, all motors, other power devices and main line disconnect also shall be shown. The control devices should be arranged in the order in which they are energized. The position of the symbol in the diagram is arranged for convenience and simplicity and does not indicate its physical position on the equipment. All wire and terminal numbers, and symbol identification markings shall be shown.

E1.5—Electrical Stock List

E1.5.1 The stock list shall show quantity, manufacturer's name, type or model of each device used plus motor horsepower frame sizes and speeds and any other information necessary to order replacement control items.

E1.6—Sequence of Operations

E1.6.1 The sequence of operations shall be worded to indicate the progression of operations of all push buttons, limit switches, relays, solenoids and all other control devices on the equipment. Graphical representation may be used to supplement the written description. Block diagrams may be used to indicate position of multiple contact devices such as drum, cam and selector switches, etc.

E1.7—Electrical Layout

E1.7.1 This drawing shall consist of an outline of the industrial equipment, showing electrical control panel, control and power devices in their relative location, and the approximate position and size of all conduits that will be installed by the purchaser.

E1.8—Standard Symbols

E1.8.1 Wiring and elementary diagrams should employ symbols according to the American Standard Graphical Symbols for Power and Control, Z32.3, except that electronic tube symbols shall conform to Graphical Symbols for Electronic Devices, Z32.10.

E1.9—Conduit in Foundation

E1.9.1 On industrial equipment requiring a foundation, the size, purpose and location of the conduit to be placed in the foundation by the purchaser shall be shown on the foundation plan.

E2 CONTROL

E2.1—General Standards

E2.1.1 Control devices shall meet the minimum requirements of the latest revisions of ASA Standard C19-1 and NEMA Standard for Industrial Control Apparatus.

Note: Precision and other small devices used for control shall conform to accepted standards for that class of devices.

E2.1.2 Magnetic motor starters not smaller than NEMA Size 1 shall be used for across-the-line motor starting.

E2.2—Disconnect Switch

E2.2.1 The equipment builder shall furnish and mount NEMA Type A manually operated, non-fusible, motor circuit switches or circuit interrupters capable of interrupting the maximum operating overload current of all the equipment connected to that circuit. These switches or circuit breakers shall disconnect all lines of all power circuits to the equipment and shall be so arranged that they may be locked in the "off" position. When requested by the purchaser, the equipment builder shall furnish fusible NEMA Type A motor circuit switches or circuit breakers.

Note: This paragraph does not apply to small bench type tools powered by a single motor rated less than 1/4 hp, or to welding transformers and their control circuits. On bench type machines the disconnect switch need not be mounted on the machines but shall be furnished.

E2.2.2 On single power source equipment control enclosures, the disconnecting means shall be made a part of the control panel and mechanically or electrically interlocked, or both, with the control enclosure door or doors. Where there is more than one power source, additional individual disconnecting means shall be provided so that all power lines to the equipment may be interrupted. All these disconnecting means shall be mounted inside the enclosures and mechanically or electrically interlocked, or both, with the control enclosure doors. The operating handles shall be grouped and located between three (3) and seven (7) feet from the operating floor.

Note: This does not apply where lighting circuits are required when the main power circuit is disconnected.

E2.2.2 (F) (W) Paragraph 2.2.2 does not apply to electric power for resistance welders or electric furnaces unless specified; however, it does apply to motor control for such apparatus.

E2.3—Protection

E2.3.1 Motor running overcurrent protection shall be provided for each motor except in the case of short-time rated motors. For such motors, motor running overcurrent protection may be omitted when protected against overcurrent in accordance with Section 4323 of the National Electrical Code.

E2.3.2 Under-voltage protection shall be provided for all motors which might cause damage to the machine or injury to the operator should they start after interruption and return to power.

E2.3.3 Where there is more than one electrically controlled or operated device on any industrial equipment, and where possible damage may be caused by the failure of any one device to function, circuits shall be arranged where practicable, so as to interrupt all operations, provided such interruption does not constitute a safety hazard to the operator or damage to the equipment or work in process. Where starting or stopping of such devices in improper sequence can result in a safety hazard to the operator or damage to the equipment or the work in process, circuits shall be so arranged as to insure the proper sequence starting and stopping of such devices. Means to operate heads individually by hand for tool setting purposes when necessary shall be installed providing the above arrangements, to prevent damage, are complied with.

E2.3.5 Where line voltage (115 vac single phase) is the only power supply to the equipment, a fused disconnect switch or circuit breaker of suitable size shall be installed.

E2.4—Motor Branch-Circuit Overcurrent Protection

E2.4.1 One Branch Circuit. The conductors supplying all motors on a single machine tool may be considered a single branch circuit, which must comply with the provisions for motor branch circuits in Article 430 of the N.E. Code as modified in Article 670 of the N.E. Code, except as specified in paragraph 2.4.2.

E2.4.2 Several Motors on One Branch Circuit. Controllers and running overcurrent protective devices for two or more motors connected to the branch circuit of a single machine tool need not comply with Section 4343 of the N.E. Code if all of the following provisions are complied with:

(a) Motor Running Protection. Each motor is protected by a motor running overcurrent protective device.

(b) Rating of Overcurrent Protection. The branch circuit has over-current protection of a rating equal to that specified in Section 4342 of the N.E. Code for the largest motor connected to the circuit plus an amount equal to the sum of the full load current ratings of the other motors on the machine tool connected to the same circuit.

(c) Enclosure. The control equipment and running protective devices are mounted in enclosures or compartments complying in all respects with the provisions of 2.5.2, 2.5.4, 2.5.6, and 2.5.7, of these standards.

(d) Conductors. The conductors of the branch circuit comply with the provisions of paragraph (b) of Section 4343 of the N.E. Code.

E2.5—Control Panel Enclosures and Compartments

E2.5.1 (a) For the purpose of these Standards, the word "enclosure" means the metal housing for the control panel whether mounted on the industrial equipment, or separately mounted.

(b) A "compartment" is a space within the base, frame, or column of the industrial equipment.

E2.5.2 Control panels shall be enclosed and shall be mounted in such a manner and position as to guard it against oil, coolant, dirt and dust. If the control panel is mounted in the base or column of the industrial equipment, it shall be readily accessible; it shall not be considered enclosed if the space in which it is mounted is open to the floor, the foundation upon which the industrial equipment rests, or to other compartments of the industrial equipment which are not clean and dry.

Suggested standards sponsored by the Joint Industry Conference, including representatives of the following groups: Industrial Electrical Engineering Society of Detroit, industrial equipment users, Industrial Furnace Manufacturers Association, Inc., National Electrical Manufacturers Association, National Machine Tool Builders Association, Resistance Welder Manufacturers Association.

NOTE: Data sheet No. 19 (May 1950) was incorrectly titled "JIC Identification Symbols for Hydraulic Symbols". The title should have read "JIC Identification Symbols for Industrial Piping Circuits".

GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

System for Measuring Internal Threads

While thread gages unquestionably provide the most accurate means of checking the size of an internal thread, they are not always available. Even if they are, one cannot readily determine the amount of stock to be removed to attain finish size. Therefore, it has been the practice to mount balls on points, telescope gages and even micrometers, and then to measure the computed overall dimensions with outside micrometers.

Precision balls, held in place with petroleum jelly, would slip out of place or become lost, and in our plant this procedure assumed the nature of a nuisance. We therefore took inside micrometers of various types and adapted them to internal thread checking, as shown in Fig. 1, A, B, C, D and E. For example, we set up internal mikes having projecting hubs or anvils in a thread grinder and ground threads of suitable pitch on the anvil O.D's, as shown at F and L, Fig. 1. This alteration did not affect the normal function of the mikes.

A set of adapters was then made up, as shown at G, H, J and K and mounted as indicated by F. Each of these adapters was designed to take a different size ball, using silver solder for mounting. The balls used were fractional size, the only ones commercially available. The opposite end of the adapters were tapped to match the ground thread on the mikes.

The most important consideration was to establish an exact 0.500 in. diameter from the tip of the ball to the permanent measuring point of the mikes—that is, from anvil to tip of ball—to match the calibrations. Since the usual range of an inside mike is only ½ in., this matched the end of the ball with the calibrations.

A table of constants—Table I—was prepared for the various pitches, selecting the most suitable ball and determining the projection of the ball beyond the pitch line. The addition of this constant to a mean of the pitch and minor diameters determines the desired size, simplifies calculation and practically eliminates use of formulas, the latter being

P	BD	Const.	P	BD	Const.	P	BD	Const.
4	9/64	0.0379	11	1/16	0.0081	24	1/32	0.0024
4½	1/8	0.0337	12	1/16	0.0048	26	1/32	0.0010
5	7/64	0.0319	13	3/64	0.0099	27	1/32	0.0004
5½	7/64	0.0240	14	3/64	0.0075	28	1/32	0.0002
6	3/32	0.0253	16	3/64	0.0036	30	1/32	0.0012
7	3/32	0.0150	18	3/64	0.0006	32	1/32	0.0021
8	5/64	0.0150	18	1/32	0.0084	32	1/64	0.0057
9	1/16	0.0169	20	1/32	0.0060	36	1/64	0.0042
10	1/16	0.0121	22	1/32	0.0041	40	1/64	0.0030

Table I, showing constants that simplify measurement of internal threads. "P" denotes pitch—that is, the number of threads per inch; "BD" the ball diameter; and "Const." designates the constant. The boxed section represents minus constants. Note: This table is applicable only to 60 deg threads; however, the method is useful for measuring other types of threads after simple computations. See supplementary diagram, Fig. 1, for thread calculations.

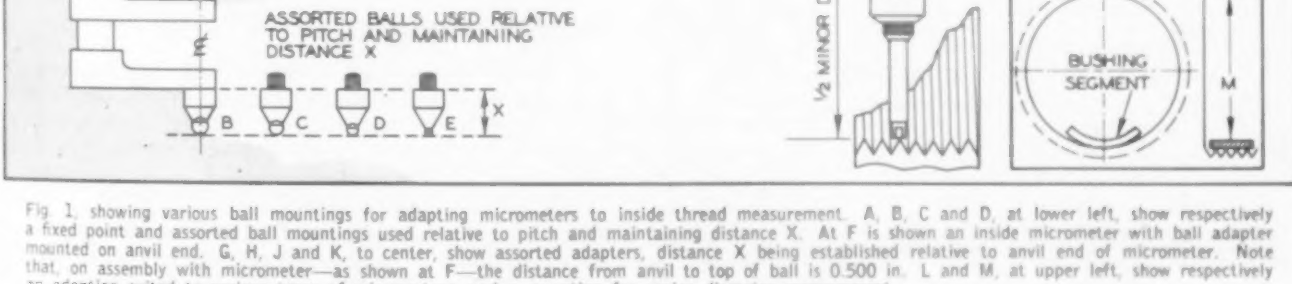


Fig. 1, showing various ball mountings for adapting micrometers to inside thread measurement. A, B, C and D, at lower left, show respectively a fixed point and assorted ball mountings used relative to pitch and maintaining distance X. At F is shown an inside micrometer with ball adapter mounted on anvil end. G, H, J and K, to center, show assorted adapters, distance X being established relative to anvil end of micrometer. Note that, on assembly with micrometer—as shown at F—the distance from anvil to top of ball is 0.500 in. L and M, at upper left, show respectively an adaption suited to various types of micrometers, and a mounting for major diameter measurement.

Inset at top left is a supplementary diagram for Table I, in which "C"—the constant in Table I—represents the projection of the ball relative to the pitch line; "R" the distance from the ball tip to the theoretical vertex, or bottom of the thread, which equals the ball radius; "P" the linear pitch; and "D" the distance from the pitch line to the theoretical vertex "d" the theoretical full depth of a 60 deg V thread; while "r" represents the ball radius.

The various thread elements may be arrived at as follows:

Constant "C" = 0.43301 X P—r. Note, here, that P implies the linear pitch, not the threads per inch. Example: the constant for a 4-pitch thread, in which the linear pitch is 0.25 in. and ball diameter is 9/64 in., would be ascertained as follows:

.43301 X .25—.0703125 (radius of ball) = 0.03794 as shown in Table I, in which the constants are reduced to four decimal places. Also, C = D — R.

D = P/4 X $\sqrt{3}$, or, .43301 X P.

R = r, b and a, these dimensions being equal.

d = P/2 X cot 30° (for 60 deg V-thread).

Inset at lower right shows how a segment of a bushing facilitates measurement of minor diameter. Since there is no opposite minor, the segment bridges the gap between thread crests. Add thickness of segment to ascertain minor diameter.

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included here merely for reference. See supplementary diagram, upper left in Fig. 1.

By screwing the proper size ball adapter to the mike, as shown, a fairly precise measurement may be made from the minor diameter to the pitch diameter. The size of the minor diameter is determined prior to threading, or, if the threads are already present, a segment of a bushing of smaller diameter and known wall thickness will permit this dimension to be ascertained with the inside mike, with or without the ball. See inset, lower right, Fig. 1.

It should be obvious that all dimensions will have only a radial variance since the minor diameter represents a fixed point. Hence, the amount of variation of a measurement with the finished size should be doubled to determine the amount of stock remaining on the pitch diameter.

We have used this system in our plant over a period of years, and with entire satisfaction. We have further augmented the set of balls with a conical point for direct measurement of major diameters since, occasionally, we have work that requires this dimension to be maintained. See M, Fig. 1.

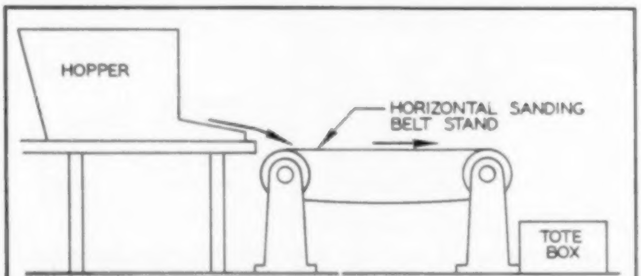
We would like to pass the idea along so as to develop a demand for precision balls of sizes falling closer to the pitch line—say comparable to wire sizes. Because of the wide range of fractional size balls, however, angle errors should be held to a minimum. As an added note, burrs should be removed before measuring soft work.

Edwin C. Austin,
Potomac Chapter, ASTE

Flash Cleaning of Die Cast Parts

Many die cast and plastic molded parts have to have flash and other surface irregularities removed before they can be used. Small, easily handled pieces are best processed by means of a sanding operation and, since the actual sanding is usually very fast, handling time becomes an appreciable part of the cycle.

The sketch illustrates a setup that eliminates one half of the handling cycle at very small initial expense. A motorized belt sander is set up horizontally instead of vertically. Either a commercially available sander may be used, or a home-made unit can be readily built. A hopper is mounted close to one end of the sander so that the operator can pick up a rough part from the hopper and place it on the belt with a minimum of motion.



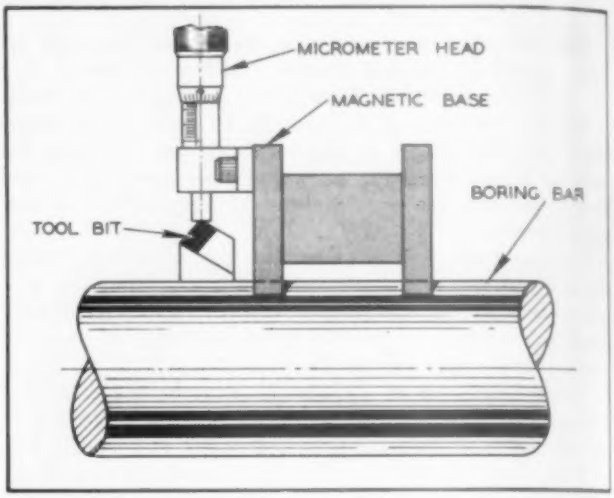
By means of a horizontal sander and conveniently adjacent hopper and tote box, parts may be sanded and then released, to be conveyed to the tote box by means of the sander belt.

The direction of travel of the belt is away from the hopper so that, after the operator has held the part on the belt as long as necessary for the operation, he merely releases it and reaches for another part. The sander then acts as a conveyor belt and drops the finished piece into a suitably placed tote box. Or, some other operation might be arranged to immediately use the piece without intermediate storage. This setup makes it unnecessary for the operator to spend time removing the piece after sanding.

Paul H. Winter
Syracuse, N. Y.

Magnetic Pedestal Gage

Under "Tools of Today" in February 1950 issue of the Tool Engineer, you published an item about a Magnetic Base, a product of the du Mont Corporation. We purchased five complete sets of these bases, supplied with dials, and these sets have proven entirely satisfactory in our plant.



An attachment to a standard magnetic base converts it to a pedestal micrometer for adjustment of tool bits in boring bars.

After studying the adjustment of tool bits in boring bars, however, the writer found a new field for these magnetic bases. That is, that by mounting a micrometer head on them, as illustrated, they serve as a pedestal micrometer gage. We made a holder attachment for the base, which provides an additional convenience as it hugs the bar and does not readily slide off in use.

L. M. Lepsöe
Asst. Works Manager
Bergens Mekaniske Verksteder
Bergen, Norway

We are sure that the du Mont Corporation will be pleased at the reception, in Norway, of their magnetic bases, and equally pleased at the conversions which suggest broadening uses.

The Gadget Editor

Reduced Loading of Wheels

A considerable part of the work at our plant consists of grinding small steel plates of irregular contours to scribed lines. Because the plates are of mild steel we have had trouble due to the grinding wheel picking up "load" particles, this despite that the correct grade and grit is specified.

This loading causes repercussive "kicking" of the workpiece and makes accurate grinding correspondingly difficult; also, edge finish is poor where the plate is torn by the loading.

Considerable improvement in finish, coolness and grinding speed can be effected by dressing the weel, bringing it to rest, and then smearing the periphery with a reliable paste-type cutting compound, such as is often recommended and used for tapping operations. Alternately, a good quality cutting oil can be mixed with a thick grease, to form a stiff paste, and this is worked well into the pores of the wheel.

Only enough to cover the surface evenly is used, and any surplus is flung off on restarting. However, sufficient remains on the wheel to improve matters considerably until the next dressing, when the process is repeated.

Iran J. Peacock
Carlisle, England

L. E. Bellamy

G. A. Rogers

W. G. Ehrhardt

W. F. Sherman

D. R. Linck

E. W. Ernst

A. M. Sargent

H. C. McMillen

J. N. Edmondson

W. H. Smila

R. I. Robbins

H. B. Osborn, Jr.

Committee Chairmen Name Their Staffs

Chapters Given Wide Representation in 1950-51 Setup of National Organization

ASTE IS ROLLING up its sleeves and getting down to work on 1950-51 activities, as national committee appointments are announced by Harry E. Conrad, executive secretary.

Chairmen, to head the several phases of Society activity, have been named by President Herbert L. Tigges. In choosing their personnel, the chairmen have endeavored to select qualified men embracing as wide a range of chapter representation as possible.

Travel Costs Limit Meetings

Because of present high travel costs, most committee business will be transacted by correspondence. When meetings are required, they will be limited to members most centrally located.

One new committee has been added to the national structure, to do the spadework for the research foundation authorized by the board during its annual meeting at Philadelphia in April. A. M. Sargent of Detroit chapter, a former president, is chairman, assisted by Orlan W. Boston, Waterloo Area (Ann Arbor, Mich.); Jay N. Edmondson, Columbus, and William H. Smila, Detroit.

The deaths of Past Presidents J. A. Siegel and R. M. Lippard created two vacancies in the Judicial/Honor Awards Committee. William H. Smila of Detroit, second president of the Society, steps into the chairmanship. Ray H. Morris of Hartford and Otto W. Winter of Buffalo, will fill the vacancies. The remaining members are: T. B. Carpenter, Walter F. Wagner and Frank A. Shuler, all of Detroit; A. H. d'Arcambal, Hartford; James R. Weaver, Philadelphia, and Frank W. Curtis, Springfield, Mass.

Appointees to other committees are: Constitution and By-Laws: Dick R. Linch, Los Angeles, chairman; Edward J. Berry, Little Rhody (Providence), and Edward H. Ruder, St. Louis.

Editorial: William F. Sherman, Detroit, chairman; Joseph Penn, Indianapolis; Joseph L. Petz, Mid-Hudson (Poughkeepsie, N. Y.); Milton L. Roessel, Rochester, and A. M. Schmit, Toledo.

Three Professors Appointed

Education: Prof. Jay N. Edmondson, Columbus, chairman; C. D. Wright, Toronto; Arthur R. Diamond, Philadelphia; Prof. Myron L. Begeman, Houston, and Prof. William W. Gilbert, Waterloo Area.

Finance: Howard C. McMillen, Evansville, chairman; William F. Jarvis, Hartford, vice-chairman; George A. Goodwin, Dayton; Harry R. Nelson, Chicago, and C. Granville Sharpe, Detroit.

Handbook: E. W. Ernst, Schenectady, chairman; Frank W. Curtis, Springfield, vice-chairman, and Editor Frank W. Wilson, At Large, secretary.

Osborn Starts Second Term

Membership: Dr. Harry B. Osborn, Jr., Cleveland, chairman; Thomas C. Bradford, Worcester; Thomas J. Donovan, Jr., Philadelphia; Clifford L. Bendle, Waterloo Area; Ben J. Hazewinkel, Denver; James S. Longdon and Robert W. Miller, Piedmont; Charles M. Smillie, Detroit, and Harry H. Whitehall, Grand River Valley (Galt, Ont.).

Professional Engineering: Ralph I. Robbins, Boston, chairman. Members of Mr. Robbins' committee have not been announced.

Program: Gerald A. Rogers, Montreal, chairman; Gardner Young, Pittsburgh, first vice-chairman; J. O. Horne, Rochester, second vice-chairman; Kenneth W. Riddle, Philadelphia, secretary; Harrel M. Creasey, St. Louis; Carl N. Flick, Cincinnati; Harmon S. Hunt, Greater New York, and Edward J. Raves, Golden Gate (San Francisco).

Public Relations: Willis G. Ehrhardt, St. Louis, chairman; A. B. Clark, Cleve-

land; R. Eric Crawford, Toronto; Howard E. Campbell, Cincinnati; Carl C. Harrington, Greater New York; Charles O. Herb, Northern New Jersey; Guy Hubbard, Cleveland, and Halsey F. Owen, Indianapolis.

Standards: L. B. Bellamy, Detroit, chairman; Joseph C. Brenner, Greater New York; William Moreland, Rockford; Raymond C. Peterson, Toledo; W. A. Thomas, Windsor, Harry M. Smithgall, Philadelphia; Arthur M. Swigert and Grant S. Wilcox, Jr., Detroit.

Most of these committees plan to get together at least once before the semi-annual meeting of the board of directors at Detroit, October 13-14.

Abuses Drills to Show How Breakage Is Overcome

Washington, D. C.—At the last technical meeting before the summer recess, Potomac chapter presented Herman Goldberg of the Snow Manufacturing Co., Chicago.

Spicing his lecture with philosophical observations on the advantages of American know-how and freedom from "class subservience between supervisor and workman," Mr. Goldberg demonstrated tapping and drilling on one of his company's latest machines.

Extensive study and observation of taps and tapping, he said, led to the development of this machine incorporating "controlled pressure in feeding the tap" and a "rigid, true chucking of the tap."

To close his demonstration, Mr. Goldberg emphasized how the hazard of tap and drill breakage has been reduced, by deliberately abusing the tools in an unsuccessful effort to break them. He left with the engineers a nut tapped to $\frac{5}{16}$ x 18-NC-4 fit and retapped to a $\frac{5}{16}$ x 24-NF-4 fit so that a snug fit was maintained on both threads and neither no-go gage would start.

Two national officers were guests at Dayton's eleventh anniversary party. From left: R. J. Armstrong, first vice-chairman; M. M. Roberts, technical speaker, and general manager, Frigidaire Div., General Motors Corp.; C. R. Miller, chairman; H. L. Tigges, president, and G. A. Goodwin, national treasurer.

British Edition to T. E. Handbook to Be Published

Demand for the "Tool Engineers Handbook" in Britain and other English speaking foreign countries is so high that arrangements have been made for publication of a British edition by McGraw-Hill Book Co.'s London affiliate.

This will permit British industry to buy the Society's handbook with sterling instead of dollars, broadening dissemination of U. S. production know-how in that country.

Despite exchange difficulties, several thousand copies of the handbook have been purchased by companies and individuals in dollar-short countries.

Schmitt and Jackson Elected NAEC Officers

Detroit, Mich.—Two ASTE men won offices in the National Association of Engineering Companies in a recent election of that organization.

Walter W. Schmitt, president of Product Engineering Co., Detroit, was elected vice-president, and Walter R. Jackson, president of Modern Engineering Service Co., Berkeley, was chosen secretary-treasurer. Mr. Jackson was also elected a director.

The new NAEC officers are affiliated with Detroit chapter, ASTE.

G. M. Executive Urges Spiritual Regeneration

Dayton, Ohio—"Our American Heritage," an address by Mason Roberts, general manager of Frigidaire Div., General Motors Corp., keynoted the eleventh anniversary observance of Dayton chapter. About 100 members and guests attended the dinner meeting, held May at the Miami Hotel.

Mr. Roberts' observations on the nation's course in world affairs and the urgent need for a spiritual re-awakening to keep pace with our rapid scientific development was completely absorbing to his audience.

America, the speaker pointed out, is the last hope for a free world. He pleaded for increased participation in government by each citizen, to control the terrible implications of the H-bomb and other war weapons. R. J. Armstrong, first vice-chairman, introduced Mr. Roberts.

President Herbert L. Tigges of Toledo also spoke, outlining the Society's goal for the coming year and its benefits to members. National Treasurer George A. Goodwin, a chapter member, commented on the healthy state of the organization's finances.

Chairman C. R. Miller introduced the following past chairmen, present as special guests: Earl Johnson, H. O. Poock, Adam Lensch, Gordon Letsche, W. R. Olt, E. J. Seifreat, G. C. Tillotson and Mr. Goodwin. J. D. Blair was unable to attend and H. C. McMillen is now affiliated with Evansville chapter.

Guests included State Representatives Jesse Yoder, Leslie Meyer and George Grusemeyer, who have been instrumental in obtaining recognition of tool engineering on a voluntary basis in the state professional engineers licensing law.

Accepts Canadian Post

Buchans, Newf.—Orest A. Meykar of Greater New York chapter has accepted a position as mechanical engineer with the American Smelting and Refining Co.

Mr. Meykar is engaged in a mechanization project at the Buchans Mining Co., Ltd. subsidiary. The latter firm is expanding its lead, zinc and copper mining operations at Buchans in the interior of Canada.

Other News in This Issue

Chapter listings include member as well as meeting news.

Purtell Warns 'Connecticut Night' Audience Against Collectivism

Stamford, Conn.—The second annual "Connecticut Night," sponsored by Fairfield County chapter in collaboration with Hartford and New Haven chapters, brought together more than 500 area members and guests at Stamford, May 4.

Arranged in cooperation with the Connecticut Manufacturers' Association, the program opened with afternoon tours to seven plants in the vicinity of Stamford, followed by a social hour and a technical session. Final event was a banquet in Vonderlieth Hall at the Pitney-Bowes Co.

Speaking on "Connecticut's Prosperity and the Tool Engineer," William A. Purtell, president of the Connecticut Manufacturers Association, urged the banquet audience to become better acquainted with the American system of business and industry in order to combat the false premises and promises of collectivism and socialism.

Sees Capitalism Imperiled

Social planners, who do not understand the close relationship between the profit motive and America's high rate of production, are attempting to supplant the system with some form of collectivism, he warned. By citing examples of production increases over the years, Mr. Purtell showed that natural resources plus the human element benefit the world in ratio to the use of and improvement in tools.

His easy and convincing manner of speaking brought thunderous applause at the close of his address. A member of Hartford chapter, Mr. Purtell is president of Holo-Krome Screw Corp. of West Hartford, and a candidate for the Republican gubernatorial nomination.

Arthur F. Murray, works manager of Electrolux Corp., served as toastmaster.

Others who spoke briefly were: W. F. Bernart, executive vice-president, Pitney-Bowes Co.; George T. Barrett, Mayor of Stamford; Benjamin Bogin, vice-president, Conde Naste Publications, and president of the Stamford-Greenwich Mfrs. Council; I. F. Holland and Ray H. Morris of Hartford, former ASTE presidents; Victor H. Ericson of Worcester, Mass., Society director; Joseph P. Crosby, Boston, director-elect, and Harry E. Conrad, Detroit, executive secretary.

Blanchard Talks on Short Runs

E. Payson Blanchard, sales manager of The Bullard Co., Bridgeport, and a Fairfield County member, was the speaker at the preceding technical session, also held at Pitney-Bowes Co. His topic was "Economics of Small Lot Production." Mr. Blanchard gave explicit examples of savings possible in limited runs. A lively discussion period followed with representatives of the plants visited available to answer questions.

Mr. Blanchard's lecture on this subject at the ASTE Montreal convention last fall was published in the December issue of *The Tool Engineer.*

Plants holding open house for the visiting engineers toted up a registration of 820. A schedule planned to permit tours of at least two factories during the afternoon made this high figure possible.

At Conde Nast Publications in Old Greenwich the ASTE'ers saw typesetting, photo engraving, press runs in black and white and in color, binding and mailing of periodicals.

Visit Appliance Plant

Electrolux Corp., another Old Greenwich firm, showed high speed production and material handling methods, multiple machining of parts, and conveyors, used in manufacturing home cleaner appliances and precision motors.

Mixing tanks, tablet machines, and bottling, capping, labeling and packaging equipment engrossed those who went through the pharmaceutical products plant of the Chas. H. Phillips Co. at Darien.

Outstanding metal processing operations observed at Pitney-Bowes Co. included swaging, engraving, cam milling, gear shaping, hobbing, and copper brazing. This trip included the assembly of mailing and other business machinery.

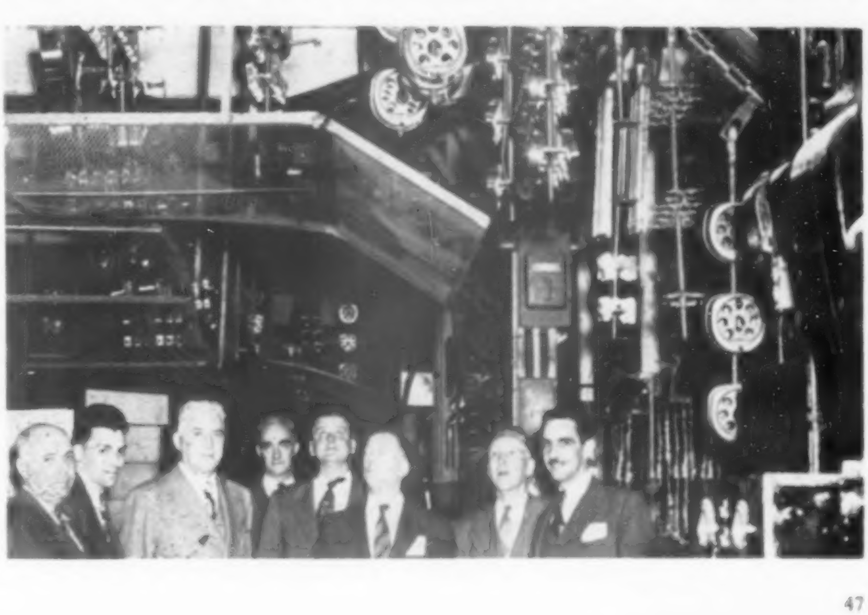
Electric razor production at Schick, Inc., Stamford, featured high volume manufacture of small parts to close tolerances, an extensive inspection system, and press work. Among other operations, the members inspected heat treating, grinding, lapping, plating, welding, and assembly methods.

A Stamford firm that has been making locks and building hardware for 82 years showed the men how iron and brass founding, and die casting, figure in this industry. Plant guides at Yale & Towne Manufacturing Co., also escorted the ASTE parties through the die cast die, pattern, press, and rod shops, and the machining, assembly, and finishing rooms.

Watch Electronic Tubes Being Made

In contrast, products coming off the lines at Machlett Laboratories, also of Stamford, are strictly developments of the 20th century. There the Connecticut tool engineers watched glass blowing, vacuum casting, glass being sealed to metal, radiant heating and soldering, induction heating, furnace brazing and other operations employed in making X-ray and electronic tubes. →

Upper: Area industrialists are speakers' table guests at Connecticut Night banquet. From left: Ben Bogin, vice-president, Conde Nast Publications; H. E. Conrad, ASTE executive secretary; A. F. Murray, works manager, Electrolux Corp.; William Purtell, president, Holo-Krome Screw Corp.; W. F. Bernart, vice-president, Pitney-Bowes Co.; George T. Barrett, Mayor of Stamford, and Wallace Guthrie, vice-president, Schick, Inc. Lower: These New England members watch wire feeders at Electrolux Corp. during one of plant tours that preceded Connecticut Night.



Between the plant tours and the technical session, the members had an opportunity to rest and enjoy refreshments during a social hour at Hugo's and the Liedertafel Club.

General chairman for the successful affair was Arthur F. Murray of Fairfield County chapter.

Other committeemen included: Fred J. Dawless of New Haven, vice-chairman; A. Douglas Proctor, secretary, Ray H. Morris, treasurer, and Don Huntting, technical session, all of Hartford; T. E. Hogan, banquet, and Eugene W. Laistner, plant visitations, both of Fairfield County.

Also: Richard Smith, Hartford, entertainment; Carl Moeller, Hartford, Frank Shute, New Haven, and W. C. McDonough, Fairfield County, transportation; Mr. Morris and W. T. Allison, Hartford, D. F. Linsley, Fairfield County, and J. A. Benson, New Haven, tickets; Fred Rawstron and Sydney P. Harris, Fairfield County, and Kenneth F. Thomas, Hartford, public relations.

George W. Norrick of Fairfield County and Mr. Dawless headed the guest committee, and Mr. Harris was in charge of guides.

Technical Writer Analyzes Jig Design

Springfield, Vt.—Joseph I. Karash of the Reliance Electric and Engineering Co., Cleveland, Ohio, was guest speaker at a meeting of Twin States chapter, held at the Trade Winds Cafe in Springfield, May 10. His subject was "Analysis of Drill Jig Design."

Author of a book on this subject, Mr. Karash has lectured before many ASTE chapters, as previously reported in *ASTE News.*

In the absence of Chairman H. H. Ranney, First Vice-Chairman Floyd MacArthur presided at the business meeting and introduced the speaker.

Copies of the Philadelphia exposition edition of *The Tool Engineer* were distributed among guests present.

William Piper, accompanied by Wallace Rostan and Roger Brown at the piano, led group singing.

Lutz Details Economies Of Air-Operated Tools

Worcester, Mass.—For their last meeting of the season, Worcester members gathered June 7 at the Svea Gille Club on the shore of Lake Quinsigamond.

J. G. Lutz, New York manager of the Pneumatic Tool Div., Ingersoll-Rand Co., talked on the use of air-operated tools. To show the savings effected with these tools, he displayed a variety of charts. Wastefulness of low air pressure and the correct selection of adequate compressor systems also were discussed.

Before the technical session John O'Lalor III, FBI agent, narrated the colorful history of this department of the government and described its functions.

Smorgasbord and a business meeting preceded the speaking program. Carroll L. Morse, chairman, presided.

Detroit Membership Men Carry ASTE Sample Case

Charles Smillie (left) Detroit chapter chairman and national membership committeeman, and Michael Pinto, chapter membership chairman, make businesslike entrance to chapter meeting at the Engineering Society of Detroit. Case Mr. Pinto carries contains all material used to interest prospects in Society membership.

Named to N-B-P Board

West Hartford, Conn.—A. H. d'Arcambal, general sales manager and consulting metallurgist, Niles-Bement-Pond Co., has been elected to the board of directors, F. U. Conard, president and general manager, recently announced.

A past president of ASTE and of ASM, Mr. d'Arcambal is widely known in these and other technical societies, for his lectures on tool steels.

Pay Tribute to Helpmates On First Ladies Night

Galt, Ont.—For their chapter's first ladies night, about 65 Grand River Valley members entertained their wives with a dinner and dance, May 19, at Leisure Lodge, Preston.

Harry Whitehall, chairman, presided and paid tribute to the efforts of the women in getting the new chapter established. Mr. Whitehall presented a gift to Mrs. William Shaw in appreciation of her secretarial assistance.

Others recognized for helping by catering at meeting luncheons were Mrs. Frank Lewis, Mrs. Harry Whitehall, Mrs. Carl Hawley and Mrs. John Ward of Galt; Mrs. Joseph Strite of Preston, and Mrs. Larry Ireland of Guelph.

Doris Pratt of Detroit, *ASTE News* editor of *The Tool Engineer*, congratulated the chapter on achieving its membership goal and presented a framed picture showing President H. L. Tigges hanging the Grand River Valley membership award in the ASTE Hall of Fame at the national headquarters building. Mr. Whitehall presented a gift to Miss Pratt on behalf of the chapter.

Door prizes were won by Henry Kearns of Kitchener and Ted Waite of Galt, both guests for the occasion. Each lady received a corsage.

After the showing of two films on the subject of home lighting, through the courtesy of Canadian Westinghouse Co., Ltd., the party continued with dancing.

Fred Lewis of Stratford entertained during dinner with accordion selections.

Indianapolis Officers and Committeemen Get Together

New chapter executives at Indianapolis, from left: Joseph Enright, program chairman; George Duncan, treasurer; Denis White, second vice-chairman; R. F. Krause, chairman; Joseph Penn, secretary; H. W. Curfman, delegate and immediate past chairman; Ernest Hilkenbach, first vice-chairman; J. W. Alexander, editorial, and H. D. [illegible], permanent historian.

Curtis Joins Van Norman

Springfield, Mass.—Frank W. Curtis, a consulting specialist on high frequency induction and dielectric heating, has been appointed chief engineer of the Machine Tool Division of the Van Norman Co., James Y. Scott, company president, has announced.

F. W. Curtis

Mr. Curtis was formerly associated with Van Norman in a similar capacity. He is a past president of ASTE and a member of its Handbook Committee.

Directory Corrections

The directory of new chapter chairmen, published in the May *Tool Engineer*, listed incorrectly the address of Thomas C. Barber, Chicago chapter chairman. Mr. Barber's present address is: Tool Service for Industry, 1809 E. 71st St., Chicago 49, Ill.

Another error occurred in the listing of Peoria chapter's meeting night. This chapter meets the first Tuesday of the month.

Sadler Advanced

Rockford, Ill.—Carl L. Sadler, Jr. of Rockford chapter has been promoted to chief engineer of the Hydraulic Div., Sundstrand Machine Tool Co., the company has announced.

Cleveland Scholarship Committee selects Donald L. Southam (inset), junior at Case School of Applied Science, as recipient of the chapter's $500 scholarship. Seated, from left: Walter Bailey, vice-president, Warner & Swasey Co.; Sholto Spears, dean of engineering, Fenn College; Edward Dase, education chairman; John Lucas, president, The Yoder Co., and S. B. Taylor, president, Parker Appliance Co.

Case Junior Is Awarded Cleveland Scholarship

Cleveland, Ohio—Donald L. Southam of Cleveland, a junior at Case School of Applied Science, is the winner of Cleveland chapter's third annual $500 scholarship.

The award, which includes a student membership in the chapter, was presented by John L. Lucas, president of the Yoder Co. and of Smaller Business of America, during a meeting at the Cleveland Engineering Society, May 12. Mr. Lucas served as a guest member of the Scholarship Committee, along with Walter Bailey, vice-president of the Warner & Swasey Co., Sholto Spears, dean of engineering at Fenn College, and S. B. Taylor, president of Parker Appliance Co.

Chapter representatives on the committee to select the candidate were Glenn Hier, scholarship chairman; Edward Dase, education chairman, and H. B. Osborn, Jr., present chapter chairman.

Technical speaker at the meeting was J. E. Walker of Reliance Electric and Engineering Co. Mr. Walker used operating equipment to demonstrate "Latest Developments in Variable Speed Controls for Machine Tools."

Before the lecture Wayne Mack, program director of Radio Station WDOK, entertained with "fluffs" occurring on the air and described the broadcasting of a television program.

Kondur With G. E.

Pittsfield, Mass.—Nicholas Kondur has been named manager of mold manufacture at the Plastics Division of General Electric's chemical department, H. M. Bruman, manager of that division, has announced.

Formerly assistant to the president of Douglas Tool Co. in Detroit, Mr. Kondur has been associated with several concerns in the Detroit area.

He has transferred his ASTE affiliation to the Springfield, Mass. chapter.

ASTE Joins With ASM To Hear Grinding Talk

Peoria, Ill.—The local chapters of ASTE and ASM met jointly May 8 to hear Dr. Leo P. Tarasov of the Norton Co. discuss "Some Metallurgical Aspects of Grinding." Dr. Tarasov's lecture as previously given before Boston chapter was reported in the June *ASTE News*.

Gordon Swardenski of the Caterpillar Tractor Co., a past chairman of the Peoria ASTE group, was technical chairman for the meeting.

Paul Unruh, Bradley University basketball star, showed a film of the final game of the N.C.A.A. tournament, in which he was an All-American participant.

* * *

The previous meeting of the ASTE group was a tour of the Keystone Steel and Wire Co. Wire drawing and the fabrication of nails and steel fence were the principal operations seen at this plant.

Air Power Is Practical In Large, Small Shops

St. Louis, Mo.—Through motion pictures, approximately 125 St. Louis members and guests made a countrywide tour of plants using air-powered tools. J. James Mudd, Midwest regional sales manager for The Bellows Co., Akron, Ohio, presented the film during a lecture on "Controlled Air Power" at a chapter dinner meeting held May 4 at the De-Soto Hotel.

The film emphasized the practicability of air power in small shops as well as in high production plants. Mr. Mudd also displayed working exhibits and answered questions from the floor after the session.

Between the dinner and technical session, films of the chapter's 1948 stag picnic were shown.

W. G. Callies, Jr., immediate past chairman, reported on the recent Philadelphia convention and exposition.

Fate of New Product Rests On Advance Research

Hartford, Conn.—"Research and Development for Profit" can mean the difference between success and failure in launching a new product, according to Walter N. Borg, president of W. N. Borg Corp., and for many years associated with the Borg-Warner Corp. Mr. Borg discussed this phase of industry from initial design request to product manufacture, at a technical meeting of Hartford chapter held recently at the Hartford Gas Co. auditorium.

Mr. Borg told how the request for product designs is thoroughly studied before preliminary sketches are made. From these initial drawings, manufacturing costs are estimated. At this stage all related patents must be examined to prevent infringements and to assure freedom of manufacture.

Market Is Surveyed

If all findings are "clear" and production costs are competitive, a sales survey is usually conducted. This will show the existing market and help determine competitive points the product must meet.

After numerous design changes incorporating the results of these preliminary studies, the final design is frozen and the production and manufacturing machinery is set in motion. A new, competitive product has been born.

Another vital phase of research and development work, emphasized by the speaker, is the improvement of an existing product, to stimulate sales.

A question and answer period bringing out further pertinent facts followed Mr. Borg's lecture. With new consumer products in the future plans of many Connecticut industries, Mr. Borg's talk is expected to show its effect in more efficient and thorough research programs.

During the preceding dinner at the City Club, Charles Blossfield, manager of the Hartford Eastern League Club, gave an amusing talk on the "Idiosyncrasies of Baseball." His remarks were spotted with well-known names and little-known facts about the national sport.

ASA Honors Bellamy

Detroit, Mich.—In recognition of his work in developing industrial standards, L. B. Bellamy, district manager of Sterling Grinding Wheel Co., has been awarded an honorary certificate by the American Standards Association.

Mr. Bellamy, who is national standards chairman of ASTE, received the award as ASTE representative on the ASA Standards Council.

Another Society member, Charles M. Pond, vice-president of Pratt & Whitney, Div. Niles-Bement-Pond Co., Hartford, Conn., was given a similar award as representative of the Metal Cutting Tool Institute.

The Standards Council formulates rules for standards development, approves standards supported by a consensus of those concerned, and decides on projects to develop.

Nearly 150 Elmira tool engineers have dinner at Remington Rand, Inc., before touring plant.

Stress Analysis Talk Climaxes Educational Program

Seattle, Wash.—Photoelasticity, the science of locating and evaluating inherent stresses and strains in mechanical structures by visualization, was described for Seattle members, May 9, by Prof. Emmett E. Day, assistant professor of mechanical engineering at the University of Washington.

Professor Day's discussion, last of a series of five educational lectures on Ferrous Metals, was given at the chapter's regular business meeting and dinner, held at the Gowman Hotel.

Photoelasticity utilizes the polaroid light principle through the medium of a transparent material such as lucite plastic, Professor Day explained. Vari-colored images projected on a screen reveal areas under stress, either static or dynamic. Stresses generated are representative, regardless of the engineering material used. However, practical interpretation and application of the values of the visualized stresses depend largely upon the experience of the investigator.

Professor Day devoted considerable time to the brittle lacquer method used for locating stressed areas. Electro-sensitive pulse devices are attached to such areas, to measure the extent of the strain in millionths of an inch.

This and other methods of stress analysis were treated comprehensively in a technical article appearing in the October, 1945, *Tool Engineer*.

Slides and elaborate demonstrations with strain indicating instruments highlighted Professor Day's lecture. He also summarized techniques advanced throughout the course.

James Smith, chapter chairman, paid tribute to the University of Washington teachers who have contributed to this educational program, presented under the direction of Prof. Karl Moltrech, chapter education chairman, and Harold Pinkerton, program chairman.

A heavy attendance of enthusiastic members and guests indicates that future programs may follow a similar pattern.

Seattle chapter's cooperation with the University of Washington, the Puget Sound Engineering Council and industrial organizations throughout the entire area reflects progressive action in the rapidly expanding economy of the Pacific Northwest.

In recognition of ASTE interest in professional, educational and industrial progress, the May issue of the Puget Sound Engineering Council publication featured Society history and objectives.

Leone Represents ASTE On ESNE Board

Boston, Mass.—A. James Leone, chairman of Boston chapter, has been appointed to the executive board of the Engineering Societies of New England, Inc. The appointment recognizes Mr. Leone's personal accomplishments in ASTE and in industry and honors his chapter.

Mr. Leone, who is chief engineer and assistant plant superintendent of the Chelsea Clock Co., Chelsea, has been active in the Boston ASTE group for a number of years. Prior to his present office he served as membership chairman, treasurer, second vice-chairman, and first vice-chairman.

Representatives of other engineering societies appointed to the ESNE executive board are: Kerr Atkinson, AIEE; Phillip Rugg, AWS; Prof. Alfred J. Ferretti, ASRE; Albert A. Fava, ASHVE; Mark Princi, ISA; Harvey B. Kinnison, BSCE; Carroll A. Farwell, ASCE, and Dean William C. White, ASME.

An organization of 21 member societies consisting of more than 7000 engineers, ESNE provides a common meeting ground for the profession through weekly publications and announcements.

Carpenter Promoted

McKeesport, Pa.—E. A. Carpenter has been appointed Chicago district sales manager for Firth Sterling Steel & Carbide Corp., T. W. Gabriel, general sales manager, has announced.

For the past four years the Milwaukee chapter ASTE'er has been sales representative for the Wisconsin and Minnesota territories of Firth Sterling's Chicago district.

Elmira Plant Tour Party Sees Typewriter Tooling

Elmira, N. Y.—Elmira chapter conducted a plant tour at Remington Rand, Inc., May 10, with 140 men participating. Glenn Bauder, assistant general manager of the plant, welcomed fellow members and their guests at a dinner in the plant cafeteria.

Separating into five groups the engineers inspected the plant, where they saw portable, office and electric typewriters, and adding machines in full production.

Highlights of the tour included high speed blanking presses using continuous coil stock fed through 6- and 7-station progressive dies at a rate varying from 100 to 400 rpm, Niagara presses with an almost foolproof hydraulic safety device, thermonic welding equipment, plastic key cap presses, spring coiling machines and a portable typewriter conveyor setup.

Motion Pictures Show Uses of Cutting Tools

Louisville, Ky.—Louisville chapter presented Robert D. Seeley of the Eclipse Counterbore Co. at the last dinner meeting of the season, held in the Kentucky Hotel, May 10.

Mr. Seeley supplemented his lecture on "End Cutting Tools in Industry" with a descriptive film.

An added feature was a film titled "Operation Crossroads," pertaining to the atom bomb.

The next dinner meeting and technical session will be held the second Wednesday in September.

New Reynolds Setup

Providence, R. I.—Through a change in company setup for Reynolds Machinery Co., Reginald R. Reynolds of Little Rhody chapter now heads Reynolds, Inc., specializing in new machinery at 2[illegible] Eddy Street.

Reynolds Machinery Co., handling used machinery only, continues at 3[illegible] Eddy Street.

RALPH E. FLANDERS
VERMONT

United States Senate
WASHINGTON, D.C.

May 24, 1950

Mr. Harry E. Conrad
American Society of Tool Engineers
Detroit 21, Michigan

Dear Mr. Conrad:

I am very greatly appreciative of the certificate of election to Honorary Membership in the American Society of Tool Engineers. I attended very early meetings of the Society when it had, I believe, but one branch in Detroit. From year to year I visited with great satisfaction the various other branches as they were set up both in the east and in the west.

Your Society met a crying need and met it well. I rejoice in your present strength and usefulness and am proud to have been honored by you.

Sincerely yours,

Ralph E. Flanders

Flanders Expresses Appreciation of ASTE Honor

Senator Ralph E. Flanders acknowledges honorary membership conferred by ASTE House of Delegates at their April meeting in Philadelphia. Engineer, editor, industrialist, banker and statesman, the Vermont legislator was an At Large member of the Society before Twin States chapter was chartered at Springfield.

Chambers Classifies Steels, Explains Selection

Galt, Ont.—Pointing out that there are some 2000 tool steels sold in Canada, Harold Chambers, chief metallurgist of Atlas Steel Co., Welland, classified them into a fundamental "working group" while addressing Grand River Valley members. Mr. Chambers was the technical speaker at a chapter meeting held April 6 in the banquet hall of the Canadian General Tower, Ltd. plant.

Highlight of the lecture was the speaker's simple and precise explanation of how to select the proper steel for the job.

As background for his talk Mr. Chambers showed a color sound film on steel making from furnace preparations to shipping and industrial uses of the various types of tool steels.

Frank Gardiner introduced the speaker and Selwyn Pritchard thanked him for his informative talk.

Harry Whitehall, chairman, opened the meeting and welcomed speakers' table guests, including George Churchill and Sydney Dunn, chairman and vice-chairman respectively, of Hamilton chapter. Mr. Dunn brought greetings from his chapter and congratulated Mr. Whitehall on the amazing progress of the new Grand River Valley group.

Chairman Whitehall conveyed the chapter's appreciation to Joseph Strite, secretary, for his contribution of a handsome folding rostrum.

At the conclusion of the program, the 110 men present enjoyed a supper catered by members' wives.

ASTE and ASQC Hear Quality Control Engineer

Poughkeepsie, N.Y.—Dorian Shainin, chief inspector, Hamilton Standard Propeller Division, East Hartford, Conn., addressed a joint meeting of the Mid-Hudson groups of ASTE and the American Society for Quality Control at the Nelson House, May 23. His subject was "Tool Engineering With Quality Control."

Quality control, according to Mr. Shainin, is a new way of thinking based on statistics. Not a cure-all, it is rather a collecting and interpretation of production information for formulating conclusions and predictions. This data becomes a basis for improvement in quality and reduction in cost, the speaker indicated.

Mr. Shainin supplemented his talk with slides and blackboard diagrams. Frank Jacquemard, ASQC section chairman, presided.

Tool to Tempo of Times, Says Aircraft Designer

Newark, N.J.—Two practical tool men gave Northern New Jersey members pointers on "Design of Jigs and Fixtures and Special Tooling," at the May 9 meeting of the chapter.

Alfred Richardson, chief designer of Wright Aeronautical Corp., Wood-Ridge, N.J., speaking on jigs and tools, observed that tooling for production had changed as the day of large quantity orders has temporarily passed. He emphasized the necessity of cooperation of those collectively responsible for the success of any tool.

Lists Design Stages

Important steps in design Mr. Richardson listed as: (1) thorough examination of blueprint, and decision on machining of part; (2) analysis of proposed method of routing, consultation of department heads to determine manufacturing methods; (3) consideration of extent of accuracy required in part, weighing cost of jig and the time it will save.

Describing economical ways of manufacturing jigs, he referred especially to vertical turret lathe jigs. Aluminum plates about three inches thick, of the same diameter as the boring mill table, are turned up with female on one side to center on the machine table. With a few stops, rests and clamps, a serviceable holding jig can be produced, he explained.

Tells How to Cut Drill Jig Costs

A steel plate to be clamped against the side of a drill press table was among methods of making cheap drill jigs discussed. Studs, clamps and bush holders can be located on such a plate. On drill jigs for ordinary runs, the speaker recommended eliminating hardened bushings and cast hardening the jig.

In conclusion he urged economizing wherever possible on elaboration in drawings for tools. An instructive discussion period followed his talk.

Herman Eberhardt, supervisor of special tooling projects, Propeller Div., Curtiss-Wright Corp., Caldwell, N.J., continued with the design and use of punches and dies. He laid emphasis on special materials to reduce die costs.

A copy of the "Tool Engineers Handbook" was awarded as attendance prize.

Talks on Deep Drawing

St. Charles, Ill.—Stanley R. Cope, president of the Acme School of Die Design Engineering, gave a slide-illustrated lecture, "Design of Deep Drawing Dies," before 104 Fox River Valley members and guests meeting May 2 at the Baker Hotel.

Leavening a highly technical subject with humor, Mr. Cope held the close attention of his audience throughout a two and one-half hour talk. He interjected personal experiences to emphasize important points of his subject.

Golden Gate Recognizes Work of Past Chairmen

San Francisco, Calif.—Golden Gate chapter dedicated its May 16 meeting to past chairmen. Approximately 160 members and guests and 20 students of a chapter engineering course were present for the dinner meeting at the Chukker Restaurant in San Mateo.

I. S. Minetti, chairman, introduced the former chapter heads and Louis Talamini presented his fellow past chairmen with honorary badges. Those on hand for the ceremony were Carl Horack, Karl Bues, Walter Kassebohm, Harold Wolpert, Edward Raves, Floyd Snodgrass, Ernest Holden and James Coulter, in addition to Mr. Talamini.

Mr. Horack reminisced about the early days of the chapter and the difficulties of chartering and making the new group self-sustaining. He paid tribute to the past chairmen for their unselfish efforts in building the chapter to its present size of 300 members.

James Meehan, sales engineer in charge of Grinding Machine Div., Brown & Sharpe Mfg. Co. and a 33-year veteran with the company, was the technical speaker.

In discussing theoretical and actual problems of high precision grinding to tolerances of 0.0001 in., Mr. Meehan pointed out the necessity of paying strict attention to small details. These include care of centers and holes, alignment of machine, steady coolant flow, even temperature of coolant, proper selection and care of wheels and diamonds.

The speaker suggested extreme care in selecting feeds and speeds, in order to obtain maximum grinding efficiency without warpage of the part through excessive heat.

After describing electronic control and measuring devices which register up to 0.00005 in., he showed slides depicting their application and a film showing the equipment under operating conditions.

Power Drive Inventors Were Crack Engineers

Philadelphia, Pa.—History of inventions demonstrates that our forebears were brilliant mechanics and, considering their resources, the equal of today's best engineers.

This conclusion followed an address on the "History of Power Transmission," given before Philadelphia chapter, May 18, by W. A. Williams, chief engineer of the American Pulley Co.

Mr. Williams, who has made an extensive study of the history of pulley, belt, and rope drives, traced methods of continuous power transmission from the cord and two-pulley arrangement first used about 1200 A.D. to the individual motorization and V-belt drives developed in the 1930's. An earlier form of power transmission, the gear dates back to 330 B.C., he said.

Mr. Williams' interesting lecture, as given before other ASTE chapters, has been previously reported in *ASTE News*.

About 70 members and guests attended the dinner meeting at the Engineers Club. Howard W. Gross, a former chairman, offered the invocation.

Bonnafe Elected V.-P.

Boston, Mass.—Oliver W. Bonnafe has been elected vice-president in charge of research engineering at Lapointe Machine Tool Co., Hudson, Mass. Associated with Lapointe for over 30 years, Mr. Bonnafe is well known for his contributions to the advancement of broaching.

In 1942, the Boston ASTE member was given an Award of Merit by the Metal Trades Association for his work in the war effort. Currently he is a member of the Advisory Committee for the Machining of Jet Engine Components, working out of Wright Field. A Registered Professional Engineer, Mr. Bonnafe lectured on broaching at the ASTE convention in April.

Upper: H. T. Welch, a past chairman of Montreal chapter, swears in new administration, from left: Samuel Pedvis, chairman; J. P. Cloutier, first vice-chairman; C. A. Gareau, third vice-chairman; T. C. Hill, secretary, and T. J. Tracey, treasurer. C. J. McDowell, second vice-chairman, is absent. Lower: James Meehan of Brown & Sharpe Mfg. Co. visits with Golden Gate officers at dinner preceding his lecture. From left: B. G. Berlien, first vice-chairman; Thomas F. MacLaren, Pacific Coast manager, Brown & Sharpe; Mr. Meehan, I. S. Minetti, chairman; Carl Horack and Karl Bues, past chairmen. Man standing not identified.

Kamola Rolls High Game

William Kamola, former program chairman of Rochester chapter, knocks 'em down, rolling high score of 195 at annual bowling party at the Eagles Club. Few of the 150 members and guests participating show Mr. Kamola's success with the alleys. But they had a good time meeting friends and playing cards. A buffet lunch was served during the evening. About 20 of the party took home door prizes.

Hydraulic Tracer Unit Cuts Machining Time

Montreal, Que.—"Hydraulic Tracer Controlled Machining" was described for 110 Montreal members and guests by Edward Barker, manager, Modern Tool Works, Toronto, who addressed the chapter's May 11 meeting.

With the aid of slides Mr. Barker showed how a hydraulic device can convert any conventional machine to a rapid reproduction unit.

A stylus follows the outline of the template, plaster model or original part used as the model for a specified operation on a particular machine. Tracer pressure against the model varies from five to eight ounces. Minute deflections cause the closely fitting tracer valve to open ports admitting pressures of 300 psi to the cylinder operating the tool slide.

Compact and mounted close to the tracer, the hydraulic power unit has a reproduction accuracy of 0.001 in. and in lathe work 0.002 in. on the diameter, according to Mr. Barker.

Typical of examples cited was the lathe work on a mild steel shaft. To turn six diameters from 1⅜ to ¾ in. with seven shoulders required 27 minutes of a skilled operator's time. By using tracer control, the time was cut to 4.7 minutes.

Introduction of this type of control is one of the most important machining developments since carbides, the speaker indicated. Time reductions coupled with volume of metal removed seem to complement the potentialities of carbides, he added.

Mr. Barker invited Montreal members visiting the Toronto trade fair to call at his plant to familiarize themselves with this development in hydraulics.

J. P. Cloutier, first vice-chairman, presided and introduced the speaker. G. S. Clarke thanked him for his lecture.

Refreshments were served through the courtesy of Modern Tool Works.

Research and Ingenuity Develop Innovations in Low Cost Car

Rockford, Ill.—While any good engineer can design a big automobile, a small car demands considerable resourcefulness, Ross Phelps, assistant chief engineer of the Nash Motor Co., told Rockford members recently as he described the development of his company's low cost "Rambler." Mr. Phelps was the principal speaker at a dinner meeting, May 3, at the Lafayette Hotel.

Noted for his work in the field of front suspension engineering, Mr. Phelps illustrated his talk with slides showing innovations in this car.

Before starting work on the new model, all types of domestic and foreign light cars were torn down and analyzed for styling and economy features. As a result management gave the engineers the following goals to shoot for: greater economy than current cars offered, reduction in weight to 2400 lb, and a seating arrangement comparable to the four leaders in the low-price field.

Front Suspension Reduces Weight

Novel in this country is the front suspension developed. Coil springs are installed between the top of the steering knuckle and a high point of the front body structure, just inside and above the front wheel. This eliminates much of the massive weight required in the front end.

Among other features and innovations discussed by Mr. Phelps were: the front seat back is divided off-center to accommodate three persons with greater comfort. Turning radius of the 100 in. wheelbase car is 18 ft 7 in., claimed to be the smallest in the industry.

Rails connecting the windshield header to the rear end structure provide a strong overhead construction. This eliminates rattles and vibrations common to convertibles. Standard accessories help reduce costs. In a coast-to-coast road test the Rambler averaged 31.409 miles per gallon.

A model of the car, displayed in the hotel dining room, was inspected by the ASTE'ers.

Public Approves NXI

After Mr. Phelps' talk, William Moore, Nash public relations man, spoke briefly about the NXI (Nash Experimental International) car to cost approximately $1000. Results of a survey sounding out public opinion on this type of automobile indicate that 70 percent of the people would like it, with changes—a single seat front for three passengers instead of two, two jump seats in back, and a 36 hp English engine or the Italian Fiat, rather than the 18 hp Fiat requiring gear shifting on hills. Many of those answering the questionnaire wanted a 50 to 75 hp engine, impossible in this price class, Mr. Moore added.

As constructed, the one experimental model was built around a Fiat 500 chassis with 83 in. wheelbase. The two-seater had an engine whose peak horsepower developed at 4200 to 5200 rpm, higher than that of conventional American-made cars.

Such a car would have a gas economy of 40 to 50 miles per gallon and a top speed of 60 mph. Weight would be approximately 1350 lb. Unit type of construction would be utilized as well as a light front and rear suspension.

The NXI model is now being torn down to incorporate some of the changes recommended, Mr. Moore informed the engineers.

Both speakers answered questions from the floor following their talks.

* * *

Some 150 members and their guests observed family night at a meeting in the Wight School Auditorium, April 26.

The saga of a 3,300 mile trip by bus, jeep, oxcart, muleback, and on foot down the Pan American Highway was shown in color films by Roger Stephens, adventurer, author, and New York publisher.

Mr. Stephens, the first man to travel the entire highway, told the exciting story of this pioneer trip. He spent only $141 during this 32-day jaunt, and he explained how the cost can be kept under $100 today.

A devotee of travel off the beaten, first class ticket trail, Mr. Stephens has written a book, "Down That Pan American Highway."

* * *

At an earlier meeting Ben C. Brosheer, associate editor of *American Machinist*, talked on "Motion Economy in Tool Design and Methods Engineering."

Mr. Brosheer quoted statistics compiled by his publication, to show that more than 43 percent of machine tools in use are 10 or more years old. Although post war developments in machine tools offer a tremendous increase in production potential, this industry is operating at only a fraction of its capacity, he said.

New designs, better operating methods, and the time element in performing operations were among other means of increasing productivity and lowering costs, named by Mr. Brosheer. To demonstrate these points he showed slides illustrating what can be done in small plants with low production requirements.

Now in their infancy, automatic loaders for machine tools are being applied to high production machines where potential return is greatest, according to the speaker.

As coffee speaker, Roger F. Waindle, ASTE director from Aurora, reported on his experience as an official observer of the recent combat maneuvers in the Caribbean.

B. C. Brosheer of American Machinist urges Rockford tool engineers to take advantage of new designs, better methods, and motion economy to increase productivity and reduce costs.

Left: Rockford members inspect Nash Rambler displayed at meeting addressed by (right): Ross Phelps, assistant chief engineer, Nash Motor Co., and William Moore of the company's public relations department.

It was the first time, Mr. Waindle stated, that representatives of industry had been invited to watch the mock warfare and to get an insight into problems confronting military equipment under actual combat conditions. The military, he believes, realizes its dependence on industry—that cooperation and coordination between the two are necessary for victory in an emergency.

The Society director also announced forthcoming events being sponsored by the national organization.

Whiteman Is Consultant

Philadelphia, Pa.—Walter F. Whiteman of Philadelphia chapter has opened a consulting service for spring suspensions and machine and tool designing of all types. Offices of the new firm are at 123 Virginia Ave., Westmont, Collingswood 7, N. J.

Mr. Whiteman has completed 12 years' work in these fields as part of the expansion program of William and Harvey Rowland, Inc.

A member of the Reception Committee at the recent ASTE convention in Philadelphia, Mr. Whiteman is affiliated with SAE and the Society for Experimental Stress Analysis.

Among ASTE Student Groups...

U. K. Section Installs Officers at Banquet

Lawrence, Kansas—The University of Kansas ASTE student section held its annual banquet and installation of officers May 19. Eighty-two members and guests attended the dinner, held in the Kansas Room of the Student Memorial Union.

After greeting guests and fellow members Toastmaster Harold Shigley introduced John Hoover, retiring chairman. Mr. Hoover briefly reviewed past activities and cited the accomplishments of each retiring officer before presenting Harold Buddenbohm, incoming chairman.

Mr. Buddenbohm introduced his fellow officers: Ralph Adkins, vice-chairman; Thomas Fisher, secretary-treasurer, and Orval Mulkey, parliamentarian. Howard O. Rust, faculty advisor for the student section, welcomed the new officers.

Speaker of the evening was B. J. George, consulting engineer, Kansas City Power and Light Co. Mr. George gave a stirring talk, "Get Out of the Rut, Brother, and Get in the Groove." His subject dealt with present problems of narrow thinking, leftist tendencies, and the fact that a little rationalization on the individual's part can stem the tide.

Senior at U. K. Patents Photoflash Safety Device

Lawrence, Kans.—Ralph E. Andrea, retiring chairman of the University of Kansas student section of Kansas City chapter, was granted a patent recently for a safety device on photoflash lamps.

The invention covered by Patent 2490769 is a small sleeve used to separate the filling material from the primer. This sleeve prevents accidental firing of the lamp from external high-frequency electrical waves such as those produced by radar equipment.

Now a senior in mechanical engineering, Mr. Andrea invented the device while employed by the U. S. Air Force Air Materiel Command at Wright-Patterson Air Force Base in Ohio. A license has been granted to the U. S. Government for the manufacture and use of the invention.

Laney Classes Visit West Coast Can Plant

San Francisco, Calif.—The American Can Co. was host for a recent plant tour by 38 students of a tool engineering course conducted at Laney Evening Trade and Technical Institute by the Oakland Board of Education and sponsored by Golden Gate chapter, ASTE. Ernest C. Holden, a past chairman of the chapter, is the instructor.

A part of the chapter's educational program, this course is designed to help men in all mechanical trades obtain a working knowledge of the fundamentals of tool engineering and tool design.

A new semester will begin September 19 at the Samuel Gompers Trade School in San Francisco. This course also will be under the direction of Mr. Holden.

Seattle Aircraft Plant Host to U. W. Group

Seattle, Wash.—Thirty-five students from the engineering departments of the University of Washington recently toured the Boeing Airplane Co. plant. The tour was arranged through the efforts of Clyde Peterson, chief of the experimental tooling division at Boeing.

Mr. Peterson, Professor Karl Moltrech of the university, F. L. Coenen, chapter vice-chairman, and Joseph Gembolis, second vice-chairman, escorted the students through the engineering and manufacturing departments of the huge aircraft plant.

Boot in New Post

Pittsburgh, Pa.—A. E. Boot of Pittsburgh chapter has accepted a position in the field as tool engineer with Morse Twist Drill & Machine Co., New Bedford, Mass.

Mr. Boot was formerly a field engineer for Carboloy Co., Detroit.

Researcher Recommends Hot Milling Hard Steels

Boston, Mass.—On tough jobs where other methods have failed, hot milling without coolant may be the solution.

This was one of the "Modern Milling Techniques" detailed by Dr. A. O. Schmidt, Kearney & Trecker research engineer, before the May 11 meeting of Boston chapter.

The hot milling procedure, Dr. Schmidt stated, is used on steels too hard to mill in the regular manner. The work is secured to the table and a sheet metal baffle erected in front of the cutter. From behind the shield a torch is directed towards the workpiece, to reduce the hardness of the material sufficiently to allow free cutting. This and other techniques were illustrated with slides.

James Leone, chairman, presided and Ralph I. Robbins, technical chairman, presented the speaker and conducted a subsequent question and answer period.

Some 200 members and guests attended the technical meeting and the preceding dinner.

Coming Meetings

CHICAGO—March 17-21, 1952. Tool Engineers Industrial Exposition, International Amphitheatre.

CLEVELAND—July 30. Annual boat trip to Cedar Point, Ohio. August 2[illegible] Annual family picnic.

DENVER—July 22-23. Fishing trip, Woods Lake Camp near Eagle, Colo. Other chapter members invited. Contact C. J. Helton, 61 S. Cherokee, Denver, Colo.

DETROIT—July 15. Picnic for members and families. Beverly picnic grounds, Mound and 12 Mile roads. Starts 10:00 a. m. Golf and baseball for men; races, games, prizes for children. Refreshments. Call Al Conti, chairman, at TR 2-5467. August 5. Golf party, place to be announced. October 13-14, Eighteenth Semi-Annual Meeting ASTE Board of Directors.

FOND DU LAC—July 29. Annual outing, Norton's Dock, Green Lake, 1:30 p.m. Boats leave 2:00 p.m. Dinner 6:00 p.m.

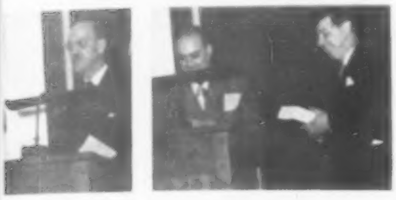
NEW YORK, GREATER—March 15-1[illegible] 1951. Nineteenth Annual Meeting ASTE.

Students of Golden Gate chapter engineering course, conducted by the Oakland Board of Education, gather at American Can Co. for a tour of the plant. Their instructor, Past Chairman Ernest C. Holden, is seated behind table. Golden Gate plans to sponsor two courses each year, alternating between San Francisco and Oakland

Scientific Tooling Is Key to Mail Order House Values

Chicago, Ill.—How good tooling has brought substantial savings to mail order house customers was related to Chicago members by Marshall A. Blu, engineer in charge of production engineering at the merchandise testing and development laboratory of Sears, Roebuck & Co., and a chapter member. Mr. Blu was the technical speaker at a meeting held May 9 at the Western Society of Engineers.

In detailing actual case histories of the development of such items as rubber heels, bathtubs, washing machine wringers, wallpaper, pressure cookers made of



Left: Marshall A. Blu, Sears Roebuck engineer, tells Chicago chapter how a mail order house tools its merchandise. Right: Malvill E. Saf (right) is happy with his "Tool Engineers Handbook" presented by Frank A. Leone of the membership committee as reward for winning chapter membership contest.

die castings, shotguns, and pinking shears, the speaker showed slides and films of tooling. These pictures included some unusual setups.

Steps followed in a Sears merchandise development project are: experimental, pre-production stage, review of program for final approval, production, and determination of costs. In the last stage, Mr. Blu pointed out, a balance must be struck between the cost of tooling and the size of the production run anticipated so that the lowest possible final unit cost can be achieved.

Chairman Thomas C. Barber introduced Mr. Blu to the audience of 250 members and guests.

Herbert L. Tigges of Toledo, ASTE president, and Harry E. Conrad of Detroit, executive secretary of the Society, also spoke briefly concerning the ASTE show and convention to be held in Chicago in 1952.

Frank A. Leone of the chapter membership committee presented a "Tool Engineers Handbook" to Malvill E. Saf, who had obtained the largest number of members during a recent membership campaign. Mr. Saf is a student at the Allied School of Mechanical Trades and a member of the ASTE student section there.

Prior to the meeting the men inspected exhibits sponsored by Brentano's Book Shop, William D. Gibson Div. of Associated Spring Corp., and Lindberg Steel Treating Co., all of Chicago.

Out-of-town guests included William B. McClellan of Detroit, national secretary, and the following chapter officers: George F. Tigges, chairman, and Robert L. Schultz, vice-chairman, Racine; George P. Torrence, vice-chairman, Rockford, and Robert W. Bayless, chairman, Peoria chapter.

Herington Tells Uses Of 'In-Between' Metal

Hamilton, Ont.—More than 80 members of Hamilton chapter heard C. E. Herington of the Meehanite Corp. of America discuss "Meehanite, Its Uses, Properties and Possibilities" at their May 12 meeting.

Mr. Herington's film-illustrated lecture on the metal said to "bridge the gap between cast iron and steel" has been reported in earlier issues of *ASTE News*.

Cyril Gradon introduced the speaker. William Feulds, who made the trip from Toronto for the occasion, thanked Mr. Herington for his talk.

Gordon Hall, a past chairman, presented a gift to John Lengbridge, a former chairman of Toronto chapter, for his services to Hamilton chapter's educational activities. Mr. Hall outlined Mr. Lengbridge's assistance in revamping the local chapter's training program to its present high level.

Rehberg, Flick Discuss Diemaking and Hydraulics

Cedar Rapids, Iowa—A double feature technical program highlighted the May 17 meeting of Cedar Rapids chapter.

The first speaker was Forrest G. Rehberg, a former tool designer for the Atomic Energy Commission, Los Alamos, N. M. His subject, "The Use of Low Melting Point Alloys in Diemaking," was illustrated with slides.

Mr. Rehberg showed how these alloys can be used for holding punches and dies securely and in alignment without the necessity of jig boring to maintain close tolerances.

Complicated die combinations can be set up for short run production. When the job is completed, the punches and dies may be removed by heating to a low temperature, then re-used in other die combinations.

Frank Flick, chief engineer for Miller Motor Co., followed Mr. Rehberg with a discussion of "Air and Hydraulic Cylinders." An extensive display of working models showed the various types of cylinders in operation.

Mr. Flick mentioned problems arising in the manufacture of these cylinders and explained methods used to obtain close tolerances and fine finishes.

Lathe Films Demonstrate Complicated Turnings

Kansas City, Mo.—Approximately 75 members and guests of Kansas City chapter met May 3 to see motion picture demonstrations of the Mona-matic and Shapemaster machines. The program was presented by S. E. Beer of Monarch Machine Co., Sidney, Ohio.

The Shapemaster film showed a specialized lathe turning, boring and facing irregular forms for glass and plastic molds. One sequence depicted the turning and boring of a square on a taper.

Prior to the film showing, Mr. Beer stressed the importance of modern machine tools to offset rising costs in industry. At the conclusion of the program, he answered a number of questions for members of the audience.

Second Vice-Chairman John Needham reported on the house of delegates' actions at the Philadelphia convention and described interesting plant tours occurring during the exposition week.

Chairman John Hoover of the University of Kansas student section announced plans for an annual banquet and installation of officers.

Tool Company Is Host For Carbide Meeting

Evansville, Ind.—Evansville members were guests of Benerson Tool Corp. for their May 8 meeting. Approximately 70 men were present to hear Paul Rehner, assistant sales manager, Carbide Alloys Div., Allegheny Ludlum Steel Corp. of Brackenridge, Pa., discuss "Carmet Cemented Carbides."

Mr. Rehner's talk included the manufacture and processing of tungsten carbides and their application to die and wear parts.

Paul Vierling, vice-president of Benerson Tool Co., was program chairman.

Following the session a lunch was served by the host company.

Lease to Represent Berg

Pittsburgh, Pa.—John H. Lease, formerly of Rees Machinery Co., is now associated with Stanley Berg & Co. as sales representative, according to a recent announcement.

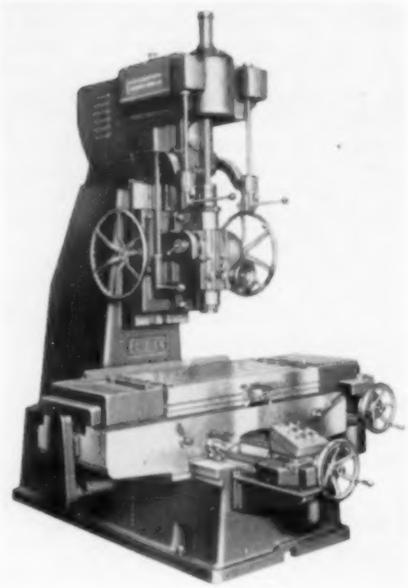
Mr. Lease is affiliated with the Pittsburgh chapter of ASTE.

More ASTE News on Page 72

Prominent at recent Evansville chapter meeting at Benerson Tool Corp. were, from left: Paul Vierling, Benerson vice-president Ralph Skehan, sales representative, Allegheny Ludlum Steel Corp.; Paul Rehner, technical speaker, and assistant sales manager, Carbide Alloys Div., Allegheny Ludlum, and Harry Newcomb, president of Benerson.

TOOLS OF TODAY

Jig Borer with Automatic Positioning

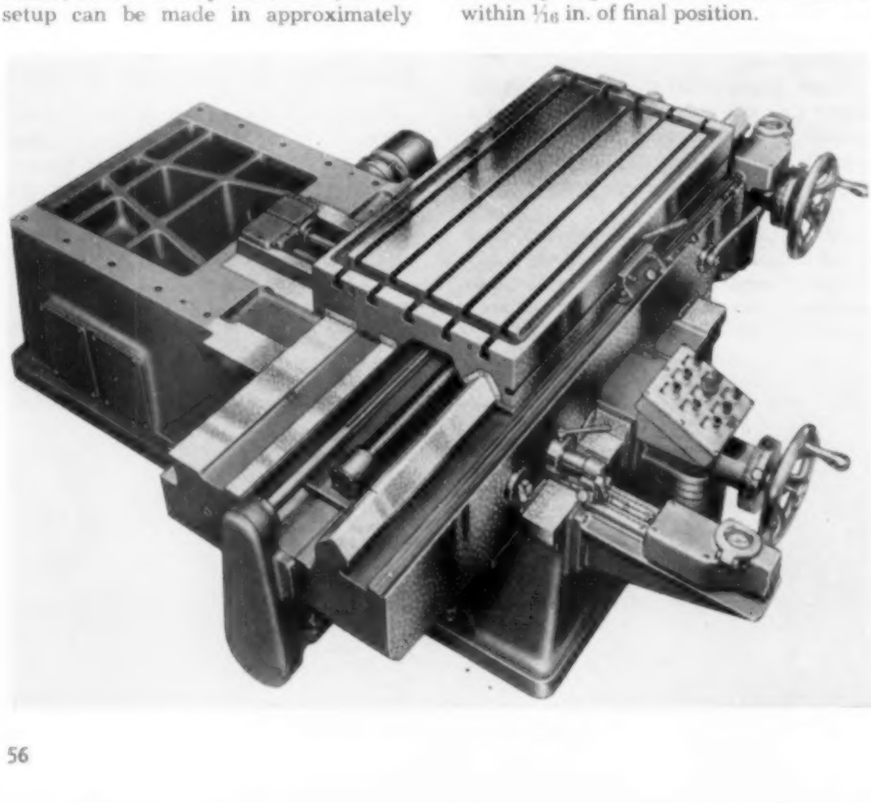


Said to be the first of its kind, a Jig Borer by the Fosdick Machine Company, Cincinnati 23, Ohio, incorporates automatic position as one of its main features. This feature reduces the time required to obtain accurate settings of a jig borer table and further obviates "freezing" of new designs due to existing jigs and fixtures.

Positioning is effected by means of measuring or duplicating bars with which, as claimed by the maker, a new setup can be made in approximately one minute. In turn, the duplicating bars, can be made in about 3 to 4 minutes per hole. When using the positioning device, the rapid traverse of both table and slide is automatically engaged. This eliminates the necessity of first rapid traversing the table to approximate position and then manipulating the positioning push botton.

The design further provides for simultaneous rapid traverse of the table and slide, and automatic positioning of both simultaneously, a feature that tends to materially reduce the time required for positioning when table and slide are operated separately. This automatic positioning enables the operator to readily locate the starting point. A separate micrometer adjusting block, placed on the table and slide—and which can also be used to locate the center of the starting hole—eliminates the usual cut-and-try jockeying for initial location.

The automatic positioning of table and slide is simple in principle. Two motors are used for rapid traversing, and two for final positioning of table and slide, all four being controlled from a 9 or 12-station push button control panel which also controls the main drive and coolant system motors. By pushing the buttom marked "Left", the table rapid traverses away from the indicator. Then, placing the measuring rods in a trough in front of the indicator, all that is necessary is to push the proper positioning button. The rapid traverse motor will then automatically rapid traverse the table to within 1/16 in. of final position.



The rods then strike a micro switch which breaks the current in the rapid traverse motor and simultaneously energizes the positioning motor. This reduces the speed and, in a few seconds, the table moves to final position, when the positioning motor stops. With the table positioned, the motor reverses to take out the entire backlash in the screw.

Referring to the photographs, it will be noted that the screw is used for rapid traversing and that the positioning shaft beneath the table drives the worm and worm wheels, the ratio of which is large so as to cut down the speed of the table. As previously implied, the shaft automatically reverses, after the table is positioned, to take out backlash. This operation is duplicated in the slide.

A safety micro switch is incorporated in the control system so that, should any part of the electrical positioning control fail, a magnetic switch will disconnect the entire positioning circuit. The device is said to position the table and slide to within plus or minus 0.0001 in., or to the graduations of the indicators.

The table of the machine has a working surface of 22 x 44 in., and a travel of 18 x 42 in. Twenty-four spindle speeds range from 30 to 1500 rpm, and three optional speed ranges are available to meet specific requirements.

In addition to jig boring, for which the machine is built with a spindle accuracy guaranteed by Fosdick to be within 0.0002 in. at the end of a 12 in. proving bar, this jig borer may be used for drilling, reaming, boring and tapping operations—for that matter, for practically any class of work within its range. T-7-1

Weld Spatter Preparation

Bausch & Lomb Optical Company, 635 St. Paul St., Rochester 2, N. Y., announces a preparation—known as Tuf-Cote—for coating safety lenses to make them more resistant to weld spatter and emery pitting. It is available to users of B & L ophthalmic lenses through an arrangement effected by Bausch & Lomb and the Wallace Optical Company, Inc., of Detroit, Mich.

The effectiveness of the preparation is derived from its resilience, which cushions the impact of particles and keeps lenses free from pits and scratches for substantially long periods of time. Lenses treated with Tuf-Cote will be supplied by all B & L sales and service divisions and affiliated offices. It may be of interest that the preparation may also be applied to conventional dresswear lenses. T-7-2

Hand-Operated Turret Press

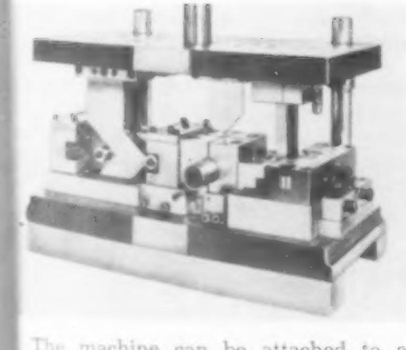
The Diamond Machine Tool Co., 3425 E. Olympic Blvd., Los Angeles 23, Calif., announces an improved hand-operated Turret Punch Press. This machine is designed to reduce the cost of piercing, embossing or forming of parts in quantities less than 500, as there are no dies to make or to set.

The press has 13 in. throat and contains 12 punches and dies, any of which may be brought under the ram for immediate use by a twirl of the index handle. Capacity is 10 tons and maximum punch size is 1½ in. for ⅛ in. mild steel. Anti-backlash gearing of turrets keeps punches in permanent alignment.

T-7-3

Tube Cut-Off Shear

A high speed Tube Cut-Off Shear, employing a unique arrangement of horizontal and vertical blades and said to be capable of cutting off up to 6,000 pieces per hour while maintaining accuracy to 0.004 in. in piece length, has recently been developed by the Vogel Tool & Die Corp., 2527 W. Moffat Street, Chicago, Ill.



The machine can be attached to a power punch press and, according to its manufacturer, produces clean cuts with minimum burr or distortion, even in tough, stringy, thin walled tubing. A built-in automatic tube stop, which can be set to control the length of the cut off piece to 0.004 in. accuracy in any desired length, assures uniform pieces. The tool is designed to cut off tubing of any size, shape or wall thickness up to 2 in. O. D., and interchangeable dies permit quick change-over.

T-7-4

Surface Plate with T-Slot

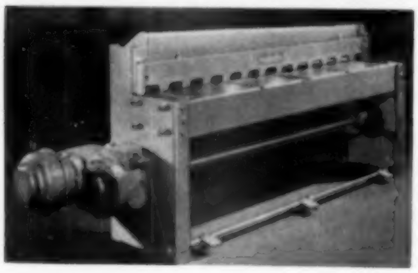
The Herman Stone Company, 324 Harries Bldg., Dayton 2, Ohio, announces a novel application for their Granite Precision Surface Plates: namely, a metal, T-slotted bar installed in a rectangular slot and bolted on the underside of the plate through holes every 12 in. In this manner, the pull is on the bottom of the plate, with the slot parallel with the side of the plate.

This application increases the adaptability of these granite surface plates to meet the more exacting demands of industry. For example, the photograph shows a dividing head, mounted on a Herman Stone plate in one of the leading gear manufacturing plants, for inspection of splined shafts.

T-7-5

Power Squaring Shears

Economy, high output, quality and stamina are the chief characteristics claimed for a line of Power Squaring Shears announced by Niagara Machine & Tool Works, Buffalo 11, N. Y. Especially designed to provide a quality power shear for small sheet metal shops and heating and air conditioning contractors, these "Series One" shears are fabricated completely from formed steel plates.



As may be judged by the photograph, they are sleek, massive and built low to the floor. Four cutting knives are used in place of single cutting edge knives; hence, here is no waiting for a dull knife to be reground. By simply rotating the knife to a new cutting edge, use is upped four times between grinds. Descriptive literature available.

T-7-6

Burr and Chamfer Machine

A high-speed precision Burring and Chamfering Machine for economical production on various types of gears—Model No. 380—is announced by the Sheffield Corporation, Dayton 1, Ohio. The machine may be had with either single or multiple stations. Spur or helical gears, as well as multi-start worms up to 7 in. in diameter, can be handled on this model. It operates continuously at a speed of 300 teeth per minute, or intermittently when equipped with an automatic work cycle to stop the machine after the part has been completely burred.

Low cost tooling and long life of cutters are among the many important features claimed for the machine. The cutters are sharpened by grinding the face angle, thus drastically reducing cutter sharpening costs when compared to the conventional pencil or hollow mill type of form cutter. One or both flanks of the tooth form, including the root, may be chamfered with each stroke of the cutter.

Compactness of design, with enclosed indexing and cutter motion control unit running in an oil bath; anti-friction bearings; chip tray; adjustable drive gear and rapid timing device combine make it a cost-cutting tool for both high and low volume production. Additional information may be obtained by writing to the company, mentioning The Tool Engineer.

T-7-7

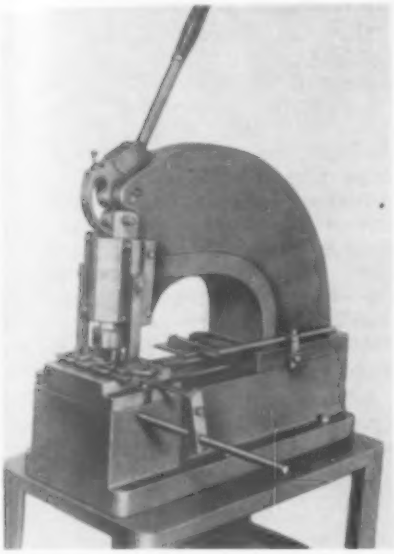
Magnet Clean-up Unit

A permanent magnet Clean-up Unit designed for use in lumber yards, upholstery shops, machine shops, and any hard-surfaced area where nails or scattered ferrous materials must be removed from floors or alley-ways is announced by F. W. Shrader Mfg. Co. 5788 Washington Blvd., Culver City, Calif. The unit comes in two models—24 and 36 in. in width—and the accumulated load may be dropped with a flip of the handle.

T-7-7-A

Precision Punch

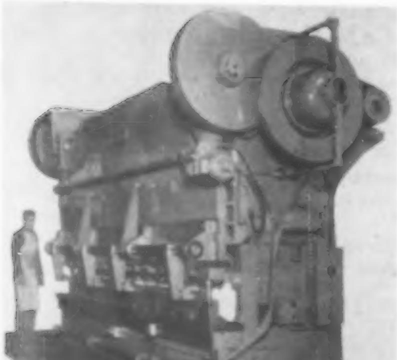
Announced by O'Neil-Irwin Mfg. Co., 37? ?ght Ave., Lake City, Minn., is the DI-Acro Punch No. 2, a precision tool designed to provide a greater throat depth than available in previous models.



A companion tool for the 24 in. DI-Acro brake and shear, it will punch into the center of any sheet that can be processed in those machines. Material capacity is 2 in. dia. hole in 16 ga. steel, with larger sizes in proportion to 4 in. diameter or equivalent. It may be mounted on a stand or on the bench, as desired. **T-7-8**

Heavy-duty Press Brake

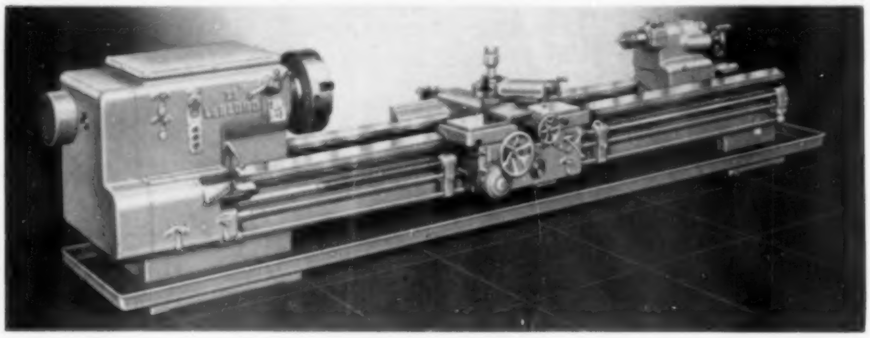
Shown here is a 120 Series x 12 ft. Cincinnati all-steel press brake, manufactured by the Cincinnati Shaper Co., Cincinnati, Ohio, equipped with a special multiple punching set-up designed to eliminate the necessity of layout as wall as single-hole punching operations. The result is a marked saving in the punching time ordinarily required for structural sections.



Where, previously, holes had to be laid out by template, with holes punched one at a time, the multiple punching permits all holes on any one side of angles, channels and other sections to be punched simultaneously. **T-7-9**

"1950" 25 in. Heavy Duty Engine Lathe

A 25 in. heavy duty Engine Lathe, completely redesigned for greater power, accuracy, and economical operation, is announced by the R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio. Known as the "1950" Series, this lathe



has 30½ in. swing over the ways, 32 spindle speeds ranging from 5 to 602 rpm, and 4-directionol power rapid traverse. Other design features include a totally enclosed quick-change box, hardened and ground steel bed ways, and automatic lubrication throughout the headstock, gear box and apron.

More economical operation of this LeBlond lathe is said to come from the redesigned headstock, which is built on the LeBlond "free-running" principle. Gears not actually in use are cut out of the train, thus leaving more of the main drive horsepower free for machining. A bearing spindle mounting contributes further to smooth performance. The lathe is arranged for 25, 30, or 40 hp, 1200 rpm main drive motor, as required. A 16-speed headstock with speeds ranging from 10 to 602 or 5 to 302 rpm is available in place of the 32-speed head if required.

LeBlond engineers state that the 4-directional power rapid traverse, furnished as standard equipment, takes the work out of operating a lathe of this size. An electric motor, built in the apron, actuates cross and length traverse and both are controlled by a single lever. Also, the tailstock can be "picked up" by means of a plunger on the carriage and moved by the rapid traverse motor. Thus, heavy units such as apron, carriage and tailstock are moved faster and without strain on the operator.

Forty-eight feeds and threads may be selected from the totally enclosed quick-change box. Standard thread range is ¾ to 46, and an optional range of ⅜ to 23 is also available. Replaceable hardened and ground steel bed ways front and rear are furnished at no additional charge.

The 25 in. 1950 series may be furnished in a plain bed gap model with a swing capacity of 45¾ in. The 1950 line also includes 12, 14, 16, 20, 32, 40 and 50 in. swing sizes. Complete information contained in bulletin HD-153-A.

T-7-10

Cold-Forming Stainless Tube

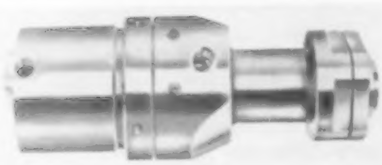
A stainless steel, said to work-harden much slower than conventional chrome-nickel steels, is now available in tubing form for applications requiring severe deforming, bending, or upsetting operations. Known as Carpenter Stainless No. 10 Tube, this product is manufactured by The Carpenter Steel Company, Alloy Tube Division, Union, N. J.

Type analysis of the material is carbon 0.08 max., chromium 16.0%, and nickel 18.0%. Developed to overcome the manufacturing difficulties associated with the rapid work-hardening of conventional 18-8 stainless, the tube is recommended by the maker for all tubular parts manufacture subject to severe working, including spinning, coining and extruding. It is also claimed that it may be satisfactorily brazed or soldered after cold working. T-7-11

Hy-Power Cylinders

Hannifin Corporation, 1120 So. Kilbourn Ave., Chicago 24, Ill., is now offering a standardized line of hydraulic cylinders built especially for "push" stroke applications using up to 5,000 psi pressure. Designated as the "Hy-Power" line, the cylinders are intended for use in combination with the Hannifin "Hy-Power" generator, which supplies pressure up to 1,000 psi for "approach" and "return" strokes, then automatically multiples pump pressure by five for the power stroke.

The cylinders are available in nine sizes ranging from 2 to 7¼ in. bore diameter and with strokes up to 6 in. on largest sizes. Output force on "push" applications ranges from 7½ to 100 tons —50-ton cylinder shown—with 5,000 psi hydraulic pressure on the head end of piston.



The piston—as shown in the sectional view—is a floating type with ground, precision step-seal rings. The cylinder body is heat treated alloy steel with precision ground bore. The piston rod is alloy steel, case hardened, and ground. The rod moves through an alloy steel, heat treated, precision gland bearing fitted with self-adjusting packing. The high pressure end of the cylinder is of one-piece construction and requires no sealing.

The "Hy-Power" cylinders are particularly suitable for use where space is limited and high output force is needed, as in many riveting, punching, and pressing operations. The design provides for simple lock nut mounting in yoke or frame. Complete specifications, data, and dimensions are contained in the recent Hannifin Bulletin 150 which will be sent to interested readers on request. T-7-12

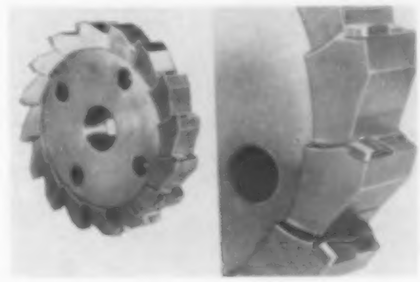
A Correction

Through a typographical error, April issue, Wearbide Bushings were erroneously called Wearhide. The correct name is Wearbide, and the bushings are manufactured by Accurate Bushing Company, Garwood, N. J.

USE READER SERVICE CARD ON PAGE 73 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Tri-Helix Face Mill

A "Tri-Helix," carbid-tipped Face Mill for the milling steel is announced by the Nelco Tool Co., Inc., Manchester,



Conn. In addition to nickel shims, sandwich brazing and alloy steel bodies, this tool incorporates added angles that are a modification of the Nelco Tri-Helix grind. It is claimed that, in actual tests, 125 cubic inches of metal per minute have been removed, consuming only 60 horse power.

In these tests, a ½ in. depth of cut 10 inches wide was milled in cast steel at 25 inches per minute table feed. The ruggedness of this tool and its unique design make it a particularly useful cutter for milling steel on the higher powered milling machines. Sizes from 6 through 14 in. diameters are available. T-7-13

High-Production Drum-Type Machine

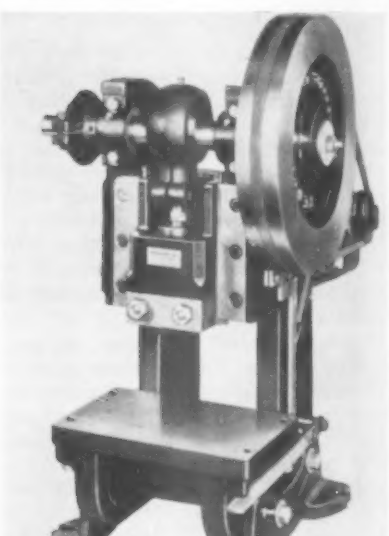
In line with the stress placed on cost-cutting manufacturing equipment, Barnes Drill Co., 870 Chestnut St., Rockford, Ill., has developed a machine in which 22 operations, on a water pump body, are combined by using two opposed hydraulic units with special heads and a 17-station indexing drum.

One head is arranged with 25 spindles, the other with 5 spindles, respectively powered with 25 HP driving motor and a 3 HP hydraulic motor, and a 15 HP driving motor and 2 HP hydraulic motor.

Operations consist of drilling, reaming, facing, boring, chamfering and hollow milling, in the process of which 12 holes and 4 surfaces are machined, all at a production rate of 90 pieces per hour at 80 percent efficiency. T-7-14

Heavy-Duty Bench Press

A 4-ton Punch Press of massive construction is announced by Kenco Manufacturing Co., 5211 Telegraph Rd., Los Angeles 22, Calif. Several notable features are claimed for this open-back, inclinable bench model press. These include: a 7 x 10 in. bolster plate permitting use of standard die sets; large, hardened and ground, adjustable V-type ram guides on each side of frame; over-sized ram area; extra heavy-duty ram designed for greater set-up ease; and a one-piece, ground crank shaft with extra heavy connecting rod.



The press has a positive, single trip mechanism, adjustable for wear and readily convertible from single trip to repeat and back without stopping motor. A hardened and ground sleeve in flywheel minimizes wear and noise. In addition, there is an internal, stationary-type, adjustable knock out arrangement; a massive, rigidly-constructed frame with extra wide opening in back to accommodate larger stock when fed from front. A full-sized, adjustable brake is standard equipment. The total weight of the press, less motor, is 250 lbs. Descriptive literature, with full specifications and prices, will be sent on application.

T-7-15

Diamond Abrasive Kit

To facilitate experimental and development work in the application of diamond abrasives, the Industrial Products Division of the Elgin National Watch Company, Elgin, Ill., has introduced the Dymo Shop Convenience Kit, containing the six most widely used Bureau of Standards grades of Dymo diamond compound.

Designed to provide almost any desired finish on carbides, tool steels and other hard materials, this kit is said to be ideal for developing new mass production finishing techniques, high precision lapping, plastic mold polishing, carbide tool sharpening, die finishing and metallurgical specimen preparation. Each grade of the compound is distinctly color identified and contained in jars with matching color tops. The jars are nested in a sturdy, compact wood case with hinged lid.

The Dymo compound is completely processed and compounded in the Elgin Industrial Laboratories in exactly determined proportions and is delivered ready for immediate application. Precision graded particles of pure diamond are permanently suspended in a specially developed synthetic vehicle to assure maximum cutting action. Complete information and prices may be had from the manufacturer. T-7-16

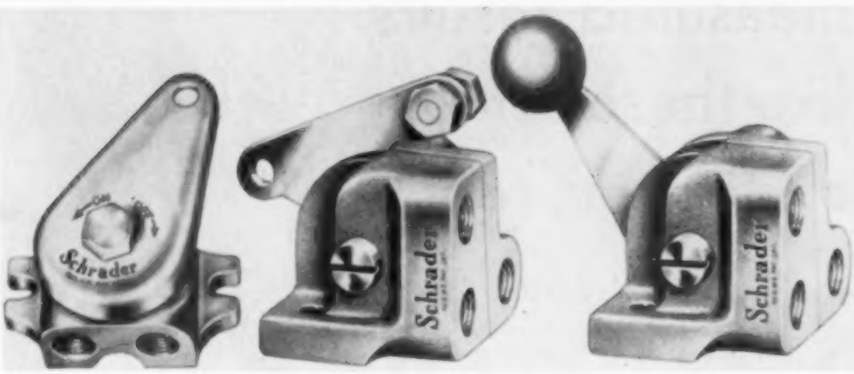
Welding-Electrode by G.E.

An improved arc-welding electrode—the W-52 AWS class E7010 — is announced by the Welding Divisions of General Electric's Apparatus Department. A reverse polarity d-c rod, the W-52 is available in 5/32 and 3/16 in. diameters for field trial.

This carbon-molybdenum electrode is specifically designed for high-quality welding of low-alloy, high-tensile steels, such as pipe lines, in all positions. It can be widely applied in the welding of high-pressure piping and of castings where high tensile strength and resistance to creep at high pressures and temperatures are desired.

Good bonding action at the fusion zone on horizontal fillets and less tendency to produce pin holing on vertical down welds are characteristics incorporated in the design. The stable arc of the new W-52 with low spatter lends for smooth operation and eliminates tendencies to short out in confined joint preparations. T-7-17

Bantam Control Valves



A. Schrader's Son, 470 Vanderbilt Ave., Brooklyn 17, N.Y., has released a complete line of small, compact 2, 3, and 4-way Operating Valves designed for use with single and double-acting cylinders. Made of forged brass and incorporating a sliding disc principal, these valves feature durability and simplicity of construction. Actual body dimensions are $1\frac{5}{8}$ x $1\frac{11}{16}$ in.

In these valves, one steel bolt holds the 2-piece body and internal parts in place, a construction that contributes to time saving and low-cost maintenance. $\frac{1}{8}$ in. ports delivering full line flow make them especially adaptable for small bore cylinders, and also for cylinders up to $3\frac{1}{2}$ in. bore in short strokes. Available for hand, foot, knee or mechanical actuation. T-7-18

Hydrabrasive Grinder

The first of a series of surface grinders featuring hydraulic operation is announced by Abrasive Machine Tool Company, East Providence 14, R.I. Known as the No. 1218 Hydrabrasive, this grinder provides unusually wide cross travel—12 in.—with a moderate table length of 18 in. Ample power is supplied by a rugged, fan-cooled, totally enclosed 3 HP spindle motor driving a 12-in. wheel. The deep, massive base minimizes vibration, and the machine has a slow speed range for crush grinding, on the one extreme, to fast conventional grinding on the other.

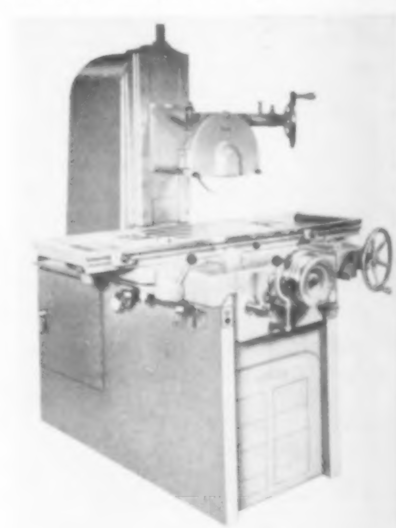


Table speeds are said to be almost instantly adjustable from $\frac{1}{2}$ ft. per min to 90 fpm, with $\frac{3}{8}$ in. of cross feed movement in $\frac{2}{10}$ of a second, making possible very appreciable savings in grinding time. In addition, the table decelerates from 90 fpm to zero in only 1 in. run-over beyond the work.

The Hydrabrasive has saddle ballways which will be of particular interest to manufacturers of gauges, dies and fine tools, and wherever precision transverse adjustment is required. The machine can further be equipped with special fixtures for high speed production grinding. Complete information available from the manufacturer. T-7-19

THE TOOL ENGINEER'S *Service Bureau*

FREE BOOKLETS AND CATALOGS CURRENTLY OFFERED BY MANUFACTURERS

Vibration Control

Vibration isolation media including springs, rubber, and cork material, pictured and described in circular G-102; contains selector chart listing machine and equipment applications with isolation recommended for highest efficiency with alternate suggestion for less critical jobs. **The Korfund Co., Inc., 48-40-J,** 32nd Place, Long Island City 1, N. Y. **L-1**

Grinders

Illustrated circular describes company's (Hanchett Type) UK traveling wheel grinder for grinding surfaces of large, heavy or bulky parts, pointing out special high-production features; includes specification table. **Mattison** Machine Works, Rockford, Ill. **L-2**

Stamping

Catalog 50 discusses recently developed process for precision piercing and blanking in small lots, illustrated by cross-sectional dimensional drawings; data includes grinding instructions, recommended applications, feeds, speeds. Super Tool Co., 21650 Hoover Rd., Detroit 5. **L-3**

Control Devices

Catalog 8303 deals with non-indicating electric, electronic and pneumatic controllers for wide variety of industrial uses; illustrated with photos, engineering drawings and specifications; plus detailed explanation of the control systems including types, accompanied by schematic diagrams. **Minneapolis-Honeywell Regulator Co.,** Industrial Div., Wayne and Windrim Aves., Philadelphia 44, Pa. **L-4**

Power Tools

Thirty-six page Catalog A describes heavy power tools for wood, metal and plastic giving complete specifications and operating conditions for machines which include band, radial, tilting arbor saws; drill presses; joiners, lathes and shapers air feeds, surfacers and flexible shaft machines. **Walker-Turner Div., Kearney & Trecker Corp.,** Plainfield, N. J. **L-5**

Cylinders, Air

Line of air cylinders illustrated and described in recently published Catalog Section No. 54 designed to help engineers lay out air circuits; drawings and tables show detailed dimensions for each model and size and recommend types and model valves best suited to various applications. **Rivett Lathe & Grinder, Inc.,** Brighton 35, Boston, Mass. **L-6**

End Mills

Four-page booklet gives advantages of short series fast spiral end mills of high speed steel; illustrated types are accompanied by specification and price lists. **National Twist Drill & Tool Co.,** Rochester, Mich. **L-7**

Separator, Coolant

Outstanding features, general construction and operation of magnetic coolant separators described in bulletin No. 300G; dimensional layout drawings, specifications and photo illustrations included plus information on attachments, lubrication and installation. **Barnes Drill Co.,** 870 Chestnut St., Rockford, Ill. **L-8**

Level, Precision

Circular No. 472-1 describes 15 in. precision level for mechanics working to close limits in horizontal plane; stresses multiple uses, advantages, and handling; text points out construction features on actual size photo. **Pratt & Whitney Div., Niles-Bement-Pond Co.,** West Hartford 1, Conn. **L-9**

Combination Tool

Folder introduces toolpost and toolholder combination outlining special advantages and illustrating its use in various type shops; price list added. **Marnat Machine Works, 50 Shotwell St.,** San Francisco 3. **L-10**

Gages

Recently published general catalog No. 58 gives factual presentation of manufacturer's line of micrometer dial gages and indicators; full size illustration convenient for visualizing dial graduations best suited to given requirements; accompanying price list keyed to proper catalog pages facilitates purchasing. **B. C. Ames Co.,** Waltham, Mass. **L-11**

Machine Shop Aids

Booklet "Machine Shop Time Savers" discusses number of accessories and attachments to increase accuracy as well as simplify work in shop touches on radii and angle dresses, circular cutting tools, vise jaws, and parallels, all purpose jaw clamps in addition to company's form grinding service. **J & S Tool Co.,** 477 Main St., East Orange, N. J. **L-12**

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Coolant Pumps

Foot controlled portable coolant pump, the Lubri-King, which may be attached where needed is described in illustrated catalog sheet; construction data and advantages also enumerated. **W. A. Horejsi Co., 2001 James Ave., No., Minneapolis, Minn.** L-13

Photography

"Functional Photography in Industry" describes processes and techniques applicable to wide range of work; non-technical text summarizes methods and results; illustrates their use for research, production and quality control. Industrial Photographic div., **Eastman Kodak Co., 343 State St., Rochester 4, N. Y.** L-14

Retainers and Punches

Catalog covers company's expanded interchangeable punch system; illustrates application of the system to dies built for numerous stamping plants, showing how it can be adapted to great many pierced products and stressing advantages in cost, time and ease of use. **Whitman & Barnes, Div. United Drill and Tool Corp.,** Plymouth, Mich. L-15

Injection Molding

Illustrated folder explains operation and advantages of recently introduced high-speed injection molding machine for high capacity plastics molding. **The Fellows Gear Shaper Co., Springfield, Vt.** L-16

Drills

Specification booklet also points out advantages of company's No. 2101 H.S.S. long flute drills. **National Twist Drill & Tool Co.,** Rochester, Mich. L-17

Power, Air and Hydraulic

Booklet dealing with applications of air and hydraulic power shows circuit diagrams indicating how it may be efficiently applied to industrial equipment; aimed at providing better understanding of air and hydraulics and the possibilities of using these types of power. **Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass.** L-18

Grinders, Portable

Bulletin 1129 describes and illustrates company's air turbine portable grinders and precision hole grinder attachment for jig borers, boring mills and similar machines; also gives complete description of industrial air turbine motors accompanied by dimensional photos and specifications. **Ousrud Machine Works Inc.,** 3927 Palmer St., Chicago 47, Ill. L-19

Rivets

Brochure shows line of tubular and split rivets as well as machines used in various types of assemblies. Photos and cross sectional drawings demonstrate use and application; price lists included. **Chicago Rivet & Machine Co.,** 9600 W. Jackson Blvd., Bellwood, Ill. L-20

Taps

"Tap Life" presents factual information on outstanding tapping operations, photos illustrate use and advantages. **Pratt & Whitney Div., Niles-Bement-Pond Co.,** West Hartford 1, Conn. L-21

Stock Handling

Illustrated folder No. 220 offers suggestions for better utilizing storage space as well as increasing efficiency and reducing servicing time; illustrates and describes line of storage equipment. **The Frick Gallagher Mfg. Co.,** Wellston, Ohio. L-22

Cutting Oil

Three folders point out advantage obtained through use of company's cutting oil by specific comparisons with case histories; stresses savings on tools, time and cost. **F. E. Anderson Oil Co.,** Portland, Conn. L-23

Remote Controls, Hydraulic

Bulletin 20-105 explains industrial use and application of hydraulic remote controls including series and multi-station, and two series of controls with intermediate transmitter; cross sectional drawings show unit construction. **C. E. Hohl, Industrial Sales Section, Sperry Products, Inc.,** Danbury, Conn. L-24

Die Sets

Catalog No. 5 presents company's entire line of tool, die and machine shop supplies, fully illustrated with price lists; spiral-bound, it is color-tabbed for easy reference. **The Die Supply Co.,** 5349 St. Clair Ave., Cleveland 3, Ohio. L-25

Grinding, Contour

A visual grinder introducing possibilities and adaptability in contour grinding of tungsten carbide to close tolerances illustrated in folder which also contains engineering diagrams to show operation. **The Cleveland Grinding Machine Co.,** 6514 St. Clair Ave., Cleveland 3, Ohio. L-26

Valve, Air

Electrically controlled air-powered air valve described in illustrated folder AU-250 explaining special advantages including compactness and guarantee against solenoid burnout; dimensional drawings and schematic diagrams included. **The Bellows Co.,** Akron, Ohio. L-27

Hones

Folder introduces addition to line of microhones pointing out special features and emphasizing advantages; also gives questions to consider in selecting a hone. **Mid-West Abrasive Co.,** Owosso, Mich. L-28

Grinding

"Disc Grinding" discusses safe handling, storage, mounting and use of abrasive discs for disc grinding and describes features peculiar to that type of precision grinding; cross sectional drawings show features and methods of mounting. **Grinding Wheel Institute,** P.O. Box 64, Greendale, Mass. L-29

Air Tools

Catalog lists additions to line of portable air tools and accessories plus redesigned models of its standard tools; illustrations and specifications present complete information. **Buckeye Tools Corp.,** 21 W. Apple St., Dayton 1, Ohio. L-30

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Portable Drafting Machine

A pocket-portable Drafting Machine is announced by Loomis Industries, 516 Park Way, Piedmont, Calif., under the trade name "Paraline". The tool which measures only $10\frac{1}{4}$ x $3\frac{3}{16}$ in. over-all and may be carried in the pocket for home, office, factory or field use, is constructed of a sturdy transparent section with precision-machined metal moving parts. The combination of a $\frac{1}{32}$ in. scale and protractor design, with the moving parts, make it useful as a T-square, parallel rules, triangle or drafting machine without any adjustments or additional parts.

Completely self-contained, the tool requires no clamps or board mountings to remain in alignment. Parallels are scaled rapidly without raising the instrument from the board, and it is said to be unexcelled for cross-hatching.

T-7-20

Research Microscopes

A series of Research Microscopes and accessories that permit exhaustive study of a wide variety of specimens, have been developed by Bausch & Lomb Optical Co., 635 St. Paul St., Rochester 2, N. Y.

Known as the Series "E", all models have an inclined binocular body that can be interchanged with a graduated monocular draw tube for photomicrography, measuring, microprojection and other research applications. The draw tube is adjustable and graduated from 146mm to 172mm in tube length. Three types of substages are also provided for routine, specialized and most critical research.

Other features include a deeply curved arm that allows ample clearance for various specimens and full rotation of the microscope stage, coated optical elements that afford maximum light transmission, and a low-position, fine focusing adjustment that is only 70mm above the table level.

T-7-21

Precision Hollow Centers

Imported for sale in the United States and Canada, by the Cosa Corporation, 405 Lexington Ave., New York 17, N.Y., are the Swiss "Dero" exchangeable Hollow Centers.

Instead of the usual single center, which is subject to serious wear and entails expensive dressing, the Dero centers incorporate an exchangeable center disc with 16 centers distributed over its circumference.

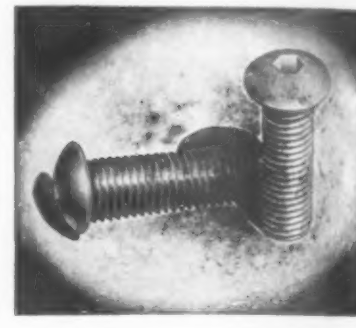
Each group of 8 centers is exactly opposite the other. When the center in use wears beyond required accuracy, the disc can be released, indexed $\frac{1}{16}$ of a turn and re-locked. When 8 centers are worn out, the disc can be quickly replaced. The Dero centers are available in Morse tapers Nos. 1, 2, 3 and 4, and the discs are available with centers ranging from 0.5 to 3 mm.—0.019 to 0.118 in.—in major diameter of cone.

T-7-22

Button Head Socket Screws

The Holo-Krome Screw Corporation, Hartford, Conn., announces the addition of a Button Head Socket Cap Screw to the firm's standard line of socket screw products. Completely cold forged, these screws have thin heads which give clean lines and lower protuberance—a feature said to be a real advantage when countersinking for flat head screws, or where counterboring for standard pattern cap screws is impractical in product design.

Another advantage, claimed by the makers, is the ability of the H-K button heads to retain the true hex shape, well defined corners and smooth taperless walls of the sockets without deformation under repeated tightening and loosening operations, thus eliminating replacements and the danger from sharp burred heads.



These screws are now available, as standard, in diameters from No. 8 to [illegible] in. inclusive, standard lengths $\frac{1}{2}$ to [illegible] in. Threads are N.C. except for the No. 10 diameter which is also available in N.F. All threads are held to a Class 3 thread fit. T-7-2[illegible]

All-Metal Scales

Of interest to draftsmen and other users of measuring scales is the retention of extreme accuracy claimed for a line of All-Metal Triangular and Flat Scales, manufactured by Cal-Pan Corp., Alhambra, Calif.

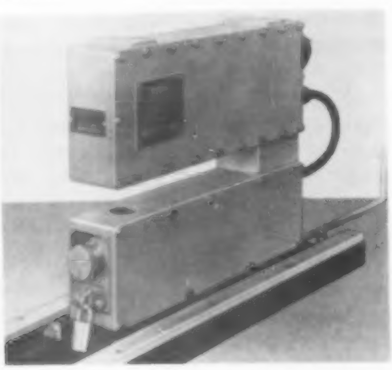
Three basic accuracy characteristics are claimed for these all-metal scales: accuracy in design—the position of each graduation is computed to [illegible] decimal plates for engine engraving on a "master" at 68 deg. F.; each scale is an exact duplicate of its "master", with needlesharp graduations in black against a white background; each scale has an even coefficient of expansion throughout of 0.0000135 per degree of Fahrenheit temperature, thus assuring permanent retention of accuracy.

The surfaces of the Triangular Scales form an "Inverted-V" which brings the fine edges of the scales right down to the paper for easy, accurate measurements without the flat surfaces ever touching the work. Both Models B-1[illegible] Architects and B-161 Engineers scales are 12-inches in length, weigh approximately 4 ounces. T-7-[illegible]

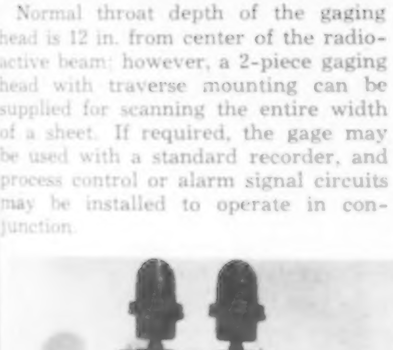
Beta Ray Continuous Gage

Pratt & Whitney, Division Niles-Bement-Pond Co., W. Hartford, Conn., announces an instrument—the Beta Ray Continuous gage—that utilizes radioactive isotopes for the gaging of continuous strip material. It is non-contacting and will measure the thickness of wet, sticky, highly polished or soft materials.

The gage operates in conjunction with a standard meter to indicate any deviation in the thickness of strip or sheet including steel and non-ferrous metals and materials. Essentially a weighing device, it measures the weight per unit area of the moving strip by passing a small beam of beta rays—actually high speed electrons—through the strip. Readings are said to be accurate to 1 percent.



Normal throat depth of the gaging head is 12 in. from center of the radioactive beam; however, a 2-piece gaging head with traverse mounting can be supplied for scanning the entire width of a sheet. If required, the gage may be used with a standard recorder, and process control or alarm signal circuits may be installed to operate in conjunction.



Also by Pratt & Whitney, is a Tri-Roll Comparator designed to speed

thread inspection on quality control. Designed to be operated with minimum skill and without computations or auxiliary equipment, the gage incorporates two stationary rolls and one roll mounted on a preloaded armature, between which parts to be gaged are cradled. A dial indicator, graduated in increments of 0.00025 in., gives cumulative errors in lead, angle and pitch diameter.

Initial setting is established with a master or setting plug, after which any deviation over or under is registered on the dial. Thus, classes 1A, 2A and 3A Unified Threads may be checked from the same initial setting. Either right or left hand threads may be checked.

T-7-25

USE READER SERVICE CARD ON PAGE 73 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

TECHNICAL SHORTS . . .

An engineering service is offered to industries which have dust problems or which use moisture penetration in processing or maintenance.

The method, proposed by the Johnson-March Corp. of Philadelphia, is based on scientific application of liquid diffusion compounds and is said to have practical low cost applications in power plants to control dust in belt galleries and stockpile, and in refractory plants, foundries and other plants for controlling dust and for speeding penetration of moisture or oil as a conditioner, especially in controlling of dust incident to unloading dust collector bins.

Various liquid diffusion chemicals have been available for some time, but, according to George Mau, vice-president of Johnson-March, the problem, which is three-fold, is in the selection of the proper liquid diffusion compounds for the particular job, the controlled proportioning of the compound in the carrying medium, be it water, oil or other liquid; application of the proper spray pattern in right location to produce automatic, effective and economical results.

Claims to understanding of the problems and the solution resulted in the establishment of the company's service division with engineers to design and supervise installation of an adequate liquid diffusion system.

Recommendations for bolt, nut and cap screw dimensions will be made shortly to official British and Canadian standards groups which, if adopted, will mean virtual unification with the American standard. They will be made by a 12-man British and a 5-man Canadian delegation representing trade and technical societies, industry and armed services who met recently with the Sectional Committee on Bolts, Nuts and Fasteners of the American Standards Association.

According to reports from the conference, dimensions discussed were mainly for hexagon-head bolts and nuts for which the threads already are unified, while size ranges agreed upon are aimed at greater simplification. Adoption of the unification would intensify the benefits of interchangeability, it is believed, as present differences in size ranges of heads of American and British bolts and nuts make unidentical clearances for wrenching. This is especially important when considered in the light of American military equipment and industrial goods, bolts and nuts of which cannot be replaced in Britain with English parts.

A recently set up procurement program is aimed at helping the small businessman who can produce or furnish products the government is buying obtain quick information on when, where and in what quantities the armed services and federal supply are buying.

Field offices of the Department of Commerce and the Chambers of Commerce of many cities have been selected as information centers. Daily summary of all invitations to bid are received at the centers in sufficient advance of bid opening date so prospective bidders will have time to secure complete bid proposal and make up their bids.

Through the joint procurement program, two advantages are anticipated: smaller business should be assured an equitable bidding opportunity, and the government will uncover many new sources of supply.

A national survey, initiated by the National Tool and Die Manufacturers Association, now is under way to collect data on products and services offered by contract shops in the special tool and die industry.

According to the association's executive secretary, George S. Eaton, the survey is in the interest of national preparedness thus insuring the effective utilization of the special tool and die industry in emergency and avoid the difficulties of World War II.

Through the data obtained, including a list of competent shops, their facilities and their manpower requirements, there would be up-to-date information on competent shops available at all times for use by government agencies in case of war and could be utilized in placing orders for special tooling at shops best able to handle them.

North East West South IN INDUSTRY

Recent appointments at the Apparatus Department of **General Electric Co.**, included the naming of **G. L. Phillippe,** formerly auditor and assistant to the comptroller, to succeed the late G. S. Hyatt as department comptroller. **J. P. Keller**, previously superintendent of all generator and turbine bucket manufacturing, for all the department's turbine division, was made assistant to the manager, industrials divisions, and **L. E. Newman**, assistant manager of the Lynn turbine and gear sales division, was named to succeed Mr. Keller.

Clarence H. Linder became manager of engineering and acting manager of manufacturing of General Electric's affiliated manufacturing department. Prior to the appointment, Mr. Linder was assistant to the general manager of the apparatus department.

Two other promotions made **C. C. Clymer** manager, materials handling and testing equipment div., to replace **M. A. deFerranti** who was named assistant to the manager, parts div., aircraft gas turbine div.

Forty-six employees of **Manhattan Rubber Div., Raybeston-Manhattan, Inc.,** were honored as new members at the recent annual dinner of the Manhattan Pioneers, company organization made up of employees whose services with the company run more than 25 years. The group now has more than 600 members.

Announcement made from the **Universal-Cyclops Steel Corp.** has named **J. L. Stewart** and **R. L. Springer** as assistant district managers of the company's Chicago branch. Mr. Stewart formerly was sales representative.

John F. Miller was recently elected vice-president of **Illinois Tool Works.** Mr. Miller, who joined the Chicago company last September, will continue to manage the engineering, manufacture and sale of standard metal cutting tools and will also direct development and marketing of the firm's newer line of graphic inspection equipment.

Earlier, **Austin E. Cole** was voted treasurer of the Chicago company. Mr. Cole's election comes after 14 years of service with the firm.

Selden **T. Williams** has been elected president of **A. Schrader's Son, Inc.** div. of Scovill Mfg. Co. Mr. Williams, who joined Schrader's in 1929, was vice president of Scovill and general manager of A. Schrader's Son div. prior to accepting his present position.

The board of directors of **The Yale & Towne Manufacturing Co.** recently elected **Elmer F. Twyman** vice-president in charge of Philadelphia div. to succeed **James C. Morgan** who retired. **John A. Baldinger**, assistant to Mr. Twyman when the latter was general manager of the Automatic Transportation Co. div., has been transferred as assistant general manager of the Philadelphia plant.

Lawrence J. Kline now has been named general manager of the Automatic Transportation Co. div., succeeding Mr. Twyman.

Charles A. Dostal has retired from **Westinghouse Electric Corp.** Mr. Dostal, who completed more than 43 years of service with the company had been vice-president of Westinghouse for the past eight years.

The board of directors of Bay State Abrasive Products Co. have voted a $250,000 appropriation for additional factory buildings and equipment in order to meet increased production necessitated by interest in the company's recent abrasive developments.

George Demougeot has been named plant manager of **Sperry Products, Inc.** A graduate of Columbia University, Mr. Demougeot formerly was connected with the Ronson Art Metal Works, Inc.

J. J. Mataitis has been made tool engineer of **The Midvale Co.** Formerly with the General Electric Co., Mr. Mataitis will be in charge of tool materials and tool designing.

Roy G. Ingersoll, previously vice-president of **Borg-Warner Corp.,** has been elected president of that company to succeed **C. S. Davis** who held the position for 21 years. Mr. Davis has resigned to fill the newly created post of chairman of the board.

A third appointment announced from the company named **G. A. Shallberg**, previously executive vice-president, chairman of the executive committee. In addition, the number of vice-presidents has been increased from three to four and now includes **A. P. Emmert,** who also is president of the corporation's Warner Gear div.

A national safety contest is sponsored by **Steel Founders' Society of America** to foster gains in safety practices. Open to its member foundries, the competition will be conducted during June, July and August, with a plaque to be awarded the foundry with the least lost-time accident frequency rate for the three-month period, in each of the four size groups competing. Judging will be according to rules of the American Standards Association.

V. H. Dieterich has retired as vice-president and director of **Joseph T. Ryerson & Son, Inc.** Mr. Dieterich, who became associated with the company 45 years ago, became its vice-president in 1937.

J. P. Murphy has been transferred to the magnesium sales staff of **The Dow Chemical Co.** Mr. Murphy formerly was engaged in the company's magnesium technical service and development group.

Frank L. Blodgett has been named sales manager, **Hard Surfacing Div., Alloy Rods Co.,** according to a recent release. Mr. Blodgett's headquarters will be at the company's main office, York, Pa.

Directors of **Mid-West Abrasive Co.** have elected **Daniel Wardlaw** to a vice-presidency in charge of coated abrasive manufacturing. Mr. Wardlaw, who has been with Mid-West for more than 19 years, formerly was in charge of sandpaper manufacture.

Allen P. Beckloff has been appointed manager of the tubular products division of **Joseph T. Ryerson & Son, Inc.** Mr. Beckloff, who formerly was manager of the tubular products department at the Cleveland plant, succeeds R. W. Burt, recently appointed sales manager of the company's Chicago plant.

Coming Meetings

Aug. 7-10, First United States International Trade Fair; Navy Pier, International Amphitheatre, Coliseum and Arena, Chicago.

Sept. 18-22, Fifth National instrument exhibit, **Instrument Society of America**; Memorial Auditorium, Buffalo, N. Y.

Sept. 26-29, 1950 Iron and Steel Exposition in conjunction with the annual convention of the **Association of Iron and Steel Engineers**; Cleveland Public Auditorium, Cleveland.

OBITUARY

Walter C. Wassman, 55, and his son, **Walter G. Wassman,** 26, were drowned when their boat capsized in the Des Plaines River. Both men were associated with the **George L. Detterbeck Co.,** where the elder Wassman was manager and his son was vice-president.

MOHAWK VALLEY LEARNS HOW TO AVOID STEEL FAILURES—R. A. Gleason and Dr. Stewart G. Fletcher of Latrobe Electric Steel Co. were recent speakers on "Cause and Prevention of Common Tool Failures," at Mohawk Valley chapter. At right are: Fred Barker, chairman, and Ray Kohl of Latrobe.

A.S.T.E. News

(Continued from Page 55)

Society Gains 249 Members in Three New Chapters

New ASTE chapters at Allentown, Pa. (Lehigh Valley); Salt Lake City, Utah, and Long Beach, Calif., are off to a fast start under the steam of 249 members.

In addition to the officers listed in the charter story in the June *ASTE News*, members of Lehigh Valley are: Robert M. Allen, John G. Davis, Walter Gloor, Harrison Jones, Frank I. Mattes, Sylvester Matthews, Jacob E. Roberts, Melvin W. Stamets, Alfred S. Taylor, Anthony V. Ursic, Frank J. Viscomi and Charles H. Yeager, Cameron Pump Div., Ingersoll-Rand Co., Phillipsburg, N. J.; Francis W. Armitage, Francis W. Armitage Co.; Arthur C. Bates and James T. Brown, Lehigh University, Bethlehem, Pa.

Nose Count Is 115

Woodrow W. Bergey, James A. Eberts, Charles E. Hennigh, J. R. Isken, Charles L. Spalding and Joseph S. Varholy, General Electric Co.; Chester J. Bernhard, Hobart T. Campbell, Joseph R. Danek, Kenneth R. Hales, Maynard H. Heabner, Alfred Kendzierski, John J. Kling, Fred M. Kohles, Samuel Kuba, Stanton B. LeFever, Ralph L. Mueller.

Eric W. Nelson, David V. Oltman, Hugo Onali, Richard C. Shafer, Edward B. Zeller and C. L. Beisinger, Western Electric Co.; Harold J. Brobst, Joseph E. Durham Jr., and Edward D. Male, Bonney Forge & Tool Works, Richard T. Harper, Carney & Associates, Ltd., all of Allentown; Raymond Churchfield, Harry R. Dowson and Richard J. Muller, Dixie Cup Co., Easton, Pa.

Samuel J. Coccodrilli, Berks Engraving Co., Reading, Pa.; Ned G. Copenhaver, Worthington Mower Co., Stroudsburg, Pa.; Bernard Corwin and George O. Philip, Butler Mfg. Co., Easton; Douglas Crane, George W. Savitz and John D. Folwell, L. F. Grammes & Sons, Allentown; Vernon F. Detweiler, Northern Pennsylvania Machine & Tool Co., Souderton, Pa.; Robert C. Dimmich, Owen T. Roth, Lester H. Schey and Charles Szvetecz, Jr., Roller Smith Co., Bethlehem; Joseph Dumpert, Werner O. Miller and Harold A. Stuber, Textile Machine Works, Reading.

Lee W. Earl, Mack Truck Corp.; John Eaton and Harvey F. Mack, Sarco Mfg. Co., Bethlehem; John H. Fried, Richard R. Haskey, Russel B. Haskey, Joseph W. Kenworthy, Franklin H. Maury, Arnold Merritt, Lloyd W. Mohr, Norman D. Mohr, Albert J. Plarr and Ralph M. Steinmetz, Mack Mfg. Co., Allentown; Edgcomb Steel Co., Philadelphia, represented by Joseph J. Drexler.

Anthony J. Foderaro, Weller Mfg. Co., Easton; John M. Gallagher, City Blue Print Co., Allentown; Joseph C. Groff, Robert D. Thomas, Aldrich Pump Co., Allentown; Richard D. Gross, Reading Chain & Block Co., Reading; John G. Hagan, Spicer Mfg. Co., Pottstown; Walter R. Hayes, Michael Repchak, L & H Engineering Co., East Stroudsburg; David Jones, Hill Case Co., represented by David Jones, Philadelphia; George S. Hudimas, Mechanical Service Co., Allentown; Bror O. Hultgren, The Bellows Co., Akron; Millard I. Jackson, Belz Manning Corp., Philadelphia.

W. H. Kemper, Carpenter Steel Co., and Robert B. Ketterer, K. Lieberknecht Co., Reading; William J. Lindner, Haynes Stellite Co., and Jacob C. Manner, Manner Tool & Die Co., Bethlehem; Albert C. Metzger, Merchants Calculating Machine Co., Allentown, represented by Albert C. Metzger; William K. Moening, Machinery Assoc. Inc., Philadelphia; Paul W. Mood, W. Lloyd Nace, V & M Tool Co., Perkasie; Arthur A. Shelly, Franklin R. Moyer, U. S. Gauge Co.; Harold N. Price, U. S. Gauge Div., American Machine & Metals Co., Sellersville.

Area Covers a Dozen Towns

William J. Pearson, John Riedel, Bethlehem Steel Co., Bethlehem; Wayne E. Shannon, American Die & Tool Co., Reading; A. J. Shimer, H. N. Crowder Jr. Co., Allentown; Joseph E. Starick, Phoenix Mfg. Co., Catasauqua; Allen F. Tenny, Van Arsdale Corp., Allentown; Leo T. Troutman, Beryllium Corp., Reading; Josef Wehe, Triangle Tool Design, Perkasie; Alexander Yarema, Walter Yarema, Yarema Bros. Tool & Die Co., Allentown; F. Kalmbach Jr., General Machine Co., Emmaus.

Ernst Sussman, Valley Supply & Equipment Co., Bethlehem; John C. Naegele, Sr., Yale & Towne Mfg. Co., Reading; and Frederick M. Henke.

The Long Beach roster lists: Vsevolod S. Acoutin, Frank G. Agee, Jr., Warren E. Amsbaugh, Earl C. Baldwin, Kurt E. H. Barthel, Hubert G. Bartling, James D. Beach, Albert R. Bishop, Carlyle E. Blanchard, Walter Blazo, Louis Boe, Edward L. Bond, William O. Booth, Roger S. Brackney, Frank E. Brady

Robert W. Briggs, Thomas W. Bull, Dean J. Dechert, Richard DePont, Joseph J. Dinwiddie, William P. Engler, Jr., Vernon M. Everett.

Lester J. Findley, Hugh M. Foster, Norman K. Frieze, William H. Gardner, Raymond E. Gariss, John A. Hammer, Harvey B. Hamilton, Alexander Haralabakis, Rolland G. Harold, Nathaniel Hartnell, Wilson C. Irby, Sterling B. Jones, Robert B. Karr, Vincent F. Kearns, Jr., Robert F. Kundis, Herbert S. Lee, William B. MacKay, Bruce K. McConnell, Kenneth F. Meyer, George A. Milne, John A. Morgan, Walter N. Morrison, D. G. Muenchausen, Kenneth M. Nelson, William A. Newman, Paul L. Patterson.

Harold B. Pawasarat, Alan E. Payne, L. D. Pomerantz, Francis F. Reed, George T. Reil, Earl S. Rice, Lawrence E. Rickard, Frank N. Rolph, Cecil H. Russell, Eugene Sisson, Edward A. Tobler, Ohmer W. Waer, Vernon D. Walker, Frank D. Wallace, Albern G. Watts, Daniel B. Welty, Robert G. Wolff, and Horace Wolff, all of Douglas Aircraft Co., Long Beach.

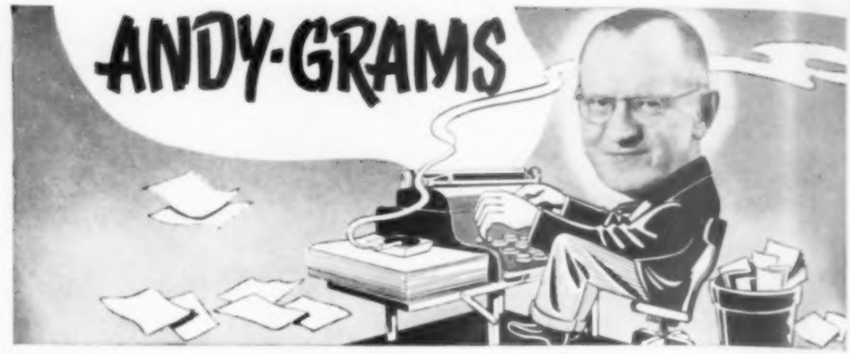
John D. Cameron, Cameron Sheet Metal Co.; Nathan A. Carr, Pacific Valves, Inc.; Roy V. Dew, Darnell Corp., Long Beach; Clarence J. Downie, Roger P. Treischel, Gilbert E. Austin, Axelson Mfg. Co.; Thomas E. Kellum, Soule Steel Co.; and Walter W. Weaver, Keller Tool Co., Los Angeles.

First ASTE Group in Utah

Salt Lake City membership includes: Frank R. Allen, Delbert P. Astin, Joseph Barron, Clarence E. Evans, Robert E. Huish, Ennis W. Inskeep, Hyman Jaffe, Maurice J. Pearcy, Lawrence L. Perry, Leon Peterson, William F. Schoenhardt, Earl S. Shipley and Donald M. Stratton, Eimco Corp., Salt Lake City.

Gerald E. Barker, Highway Machine Works, Roy; John C. Beynon, Alfred L. Evans and Ray Hogan, McGee & Hogan Machine Works, Salt Lake City; Robert J. Butler and Rex Taylor, Hill Air Force Base, Ogden; Darwin Christensen, Thomas D. Crowther, Dale Gray, Dale G. Lee, Francis M. Norr, Reid L. Rice, George Merrill Shaw, Wilford K. Somers, Bryan G. Sorenson, R. A. Sullenberger, Chester W. Winton, Jr. and John O. Canfield, Utah State Agricultural College, Logan; Leo R. Davis, Structural Steel & Forge Co., Salt Lake City; Richard J. Horrocks and Mark A. Sorenson, Pneumatic Tool Co., Independent; Paul J. Kuhni, Geneva Steel Co., Geneva; Clifton B. Larson, Weber College, Ogden; Elmer F. Lundin and Richard H. May, Lundin & May Foundry, Salt Lake City; Ross J. McArthur and C. Emerson Powell, Board of Education, Tooele.

Desmond H. Norton, Utah General Depot, Ogden; Joseph L. Oviatt, State Road Commission; Wendell P. Paxton, Mine & Smelter Supply Co., Salt Lake City; William R. Pendleton, W. O. Pendleton Co., Vernon; Carl W. Peterson, Z.C.M.I.; Joseph L. Peterson, The Galigher Co.; Lavon M. Webster, Lang Co., Salt Lake City; and Bennett O. Willhite, Carbon College, Price.



One thing about tool engineering, developments come so fast that one is hard put to keep pace. Apropos which I went out to Birmingham (Mich.), along with Harry Conrad, to look at a revolutionary drilling machine just now going into production at Sherman Industries. Designed by Bob Walder, late of the Coast, it's as nice a piece of engineering as I've seen in a blue moon. Look for a write-up in the Tools of Today, maybe this issue although I can't say for sure a/c I'm writing ahead of time.

While out that way, looked in on Charley Staples of the Staple Eng'g Company. Charley's got a nice li'l shop and is tackling intricate honing problems with typical ingenuity. Back at H.Q., enjoyed visits from Norman Brownsword, and Mike Radecki, bringing news of New England, Ed Beyma and Ot Winter, each of whom took in my private menagerie which includes the petrified Lost Weekend—one heckuva critter to meet in the dark.

On return from Canada a few weeks ago, where she'd been a guest of Grand River Valley Chapter, News Editor Doris Pratt brought back a present for me from Harry Whitehall—of all things a set of nursing nipples! Well, I know I'm getting younger day by day and all that, but demme if I've gone so far into second childhood that I have to drink my coffee through a nipple. But thanks, Harry!—they may come in handy.

An invite from Portland (Me.) Chapter to attend their annual clambake which, this year, will be broiled lobster. Afraid I'll have to tender regrets, having to brush up on horseshoe pitching—which I don't know anything about—a/c Al Conte rung me in as ump at Detroit chapter's picnic. Wait 'til I catch Al in a dark alley!

Among ASTEers who are going places, Grant Wilcox, Jr., has been elected prex of the Engineering Society of Detroit, a position that carries considerable honor in this neck of the woods. And while the support of his fellow tool engineers doubtless helped, it took more than the votes of the ASTE affiliates to put him on that pedestal.

A couple of years ago, we reviewed a book for The Tool Engineer—*The Chemistry and Technology of Plastics*, by Dr. Raymond Nauth—which has latterly been translated into Japanese. The translators—Drs. Yoshio Nagai and Kiroku Yamazaki of University of Tokyo—asked Ray to submit a dedication for the translation, and because it bears so strongly on what is to follow, I quote it in gist:

"Therefore, to all scientists . . . particularly the future scientists of Japan who, at present, are students in your . . . institutions of learning, I extend the hope that this volume may inspire . . . those scientific truths which you may . . . discover and develop. Hence you will achieve that unselfish purpose of all scientists: i.e., the advancement of all mankind towards the realization of eternal peace in this confused world.

Raymond Nauth, E.E.; Ph.D

Director of Education,

Radio, Electronic-Television Schools"

With that as an opportune introduction, I now commit the rest of my page to the cause of world peace. Despite my best efforts to shift the assignment to more capable shoulders, I found myself appointed to the Executive Committee of the Bernadotte Memorial Library at Gustavus Adolphus College, St. Peter, Minn. So, on Sunday June 4, I went up there to attend the dedication ceremonies. On my own, of course; nothing connected with the ASTE although an account of doings should be of considerable interest to several thousand of our readers both here and abroad.

Up betimes as a glorious sunrise heralded a perfect day, and fortified by a cup of coffee—for which thanks to Mrs. Evelyn Young and her staff—I went out to stroll the campus. Gustavus Adolphus is situated on a hill, overlooking the Minnesota River, from which one has a breathtaking view extending to far horizons—truly an irenic setting for a monument dedicated to peace.

During the day, I met various old *acquaintances* as well as V.I.P's from various lands, among the latter Erik C. Boheman, Ambassador from Sweden to the United States—who, incidentally, reminded me strongly of Bob Douglas; Countess Estelle Bernadotte; Dr. Ralph J. Bunch of the United Nations; and Minnesota's Governor Luther W. Youngdahl, to whom I was inadvertently introduced as a resident of Duluth. The governor greeted me warmly as a "constituent" and, not wishing to cool my welcome, I let it stand.

Lacking space, I'll not go into detail regarding the events of the day; rather I will briefly discuss the Memorial and what it stands for. Essentially, it is a $1½ million building designed to house a

library as such, a beautiful edifice in itself. In a broader sense, it is an enduring monument to a beloved son of Sweden who grew to such stature that he became a citizen of the world and a benefactor of mankind; a man who believed so strongly in the cause of peace that, on numerous occasions, he risked his life and finally gave his life that peace might be achieved—the martyred Count Folke Bernadotte!

In the dedication of this memorial, as well as in other major events of the day, it was somehow entirely fitting that the stellar role should fall to the man who was most closely associated with Count Bernadotte in Palestine and who was destined to finish the work started—Dr. Ralph J. Bunche. Entirely fitting since, in common with the stock that made up the assemblage, Count Bernadotte spurned all barriers of race, creed and color, and further because Dr. Bunche is not only an advocate of world peace in his own right, but a great statesman and a great American as well.

Qualities that impressed me about the man is a naturalness and a humility that in nowise depreciates his sense of his own worth; rather, it is the dignified humility of a man fully alive to the grave responsibilities that rest upon him as a mediator in international relations. Speaking both at the Commencement and later at the United Nations banquet, he told of the problems incidental to mediation and—what is probably known to few—that it took just seven minutes on the part of the United Nations body to unanimously elect Count Bernadotte mediator in Palestine.

Especially, Dr. Bunche brought out the need for human understanding; in effect, said that while mankind has reached astronomical heights in the science of warfare, it is still at a nadir in the science of human relations. And it is only through the channels of human understanding and fellowship than man can hope to achieve the goal of universal peace.

Well, I have said that many times myself, both in my column and in talks before Chapters; in effect, that one can neither hate nor fear that which one truly understands. Yet, never was the truth of that contention so forcibly impressed on my consciousness as when expounded in simple terms by Dr. Bunche.

True, there is little than I can do, personally, to further the cause of peace—I'm neither orator nor prominent and at best only a hack writer—yet, however minor my role may be, I would dedicate the rest of my life to that cause. Not to peace at any price nor at cost of surrender of human rights, but to the attainment of peace through human understanding and mediation. So be it.

Very humbly yours

Andy

GOOD READING

A GUIDE TO SIGNIFICANT BOOKS AND PAMPHLETS OF INTEREST TO TOOL ENGINEERS

KENT'S MECHANICAL ENGINEERS' HANDBOOK, 12th edition, two volumes. Published by John Wiley & Sons, Inc., New York; price $8.50 per volume.

One volume—*Power*, edited by J. Kenneth Salisbury—contains the latest development in power generation and applications ranging from air to atomic power. Various fuels and their characteristics are comprehensively discussed along with steam generators, engines and turbines.

Several sections are devoted to internal combustion engines—diesel, automotive and aircraft, the latter section including data for gas turbine power plants and jet propulsion systems.

One section, devoted to mathematical tables, includes numbers, geometry, trigonometry and differential and integral calculus, with explanations for application to problems.

The other volume—*Design and Production*, edited by Colin Carmichael—deals largely with typical manufacturing problems and is therefore the more closely related to tool engineering, especially so as a number of the contributors are ASTE members.

Mechanisms, mechanics and machine elements are comprehensively treated as are machine hydraulics, including fluid motors, actuators and valves. One section is devoted to quality control.

The section on mathematical tables omits any reference to calculus and is therefore a more ready reference for what may be termed design mathematics. Taken together, the two volumes are replete with up-to-date information on practically all phases of industrial theory and practice.

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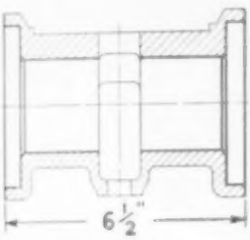

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eliminates secondary operations on the POTTER & JOHNSTON 5DELX AUTOMATIC

Get the benefits of greater accuracy, better work, more savings, by sending a sample of your work for P&J Tooling Recommendations based on precision, speed, economy. We'll engineer the Tooling, turret face by turret face, and present the facts on this detailed Estimate Sheet, without obligation.

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MULTIMOLD	FAIR	MEDIUM	FAIR	FAIR	GOOD	FAIR	BEST	FAIR	BEST
DURAMOLD A	FAIR	LOW TO MEDIUM	FAIR	POOR	BEST	POOR	*BEST	BEST	FAIR
CR-MO-W	GOOD	MEDIUM	BEST	GOOD	FAIR	GOOD	GOOD	GOOD	POOR
CR-MO-V	GOOD	MEDIUM	BEST	GOOD	FAIR	GOOD	GOOD	GOOD	POOR
57 HOT WORK	BEST	HIGH	BEST	GOOD	FAIR	BEST	FAIR	GOOD	POOR
HOT WORK 8	BEST	HIGH	BEST	BEST	FAIR	BEST	FAIR	GOOD	POOR

*Poor machinability when annealed for best hobbing.

6 top-flight Tool Steels for DIE-CASTING DIES

TYPICAL ANALYSIS

	C	Cr	Mo	W	V
Multimold	0.35	0.80	0.30	....	....
Duramold A	0.07	4.50	0.45	....	....
Cr-Mo-W	0.35	5.00	1.65	1.55	....
Cr-Mo-V	0.40	5.25	1.20	....	0.90
57 Hot Work	0.35	2.75	....	9.00	0.30
Hot Work 8	0.60	3.60	8.50	....	1.75

Each of these six fine tool steels has distinct advantages for die-casting dies. Which is the best? That all depends on the relative importance of the various properties required for each die. The chart on this page is a general guide for selecting Bethlehem grades which have been thoroughly proved for die-casting applications.

Besides relying on your own tool steel experience, remember to call on Bethlehem when you need assistance. Our staff of metallurgists is at your service, whether your problem involves the selection of the right tool steel or its proper heat-treatment.

Full details are yours for the asking. There's a Bethlehem sales office or tool-steel distributor near you. Or write us at Bethlehem, Pa.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

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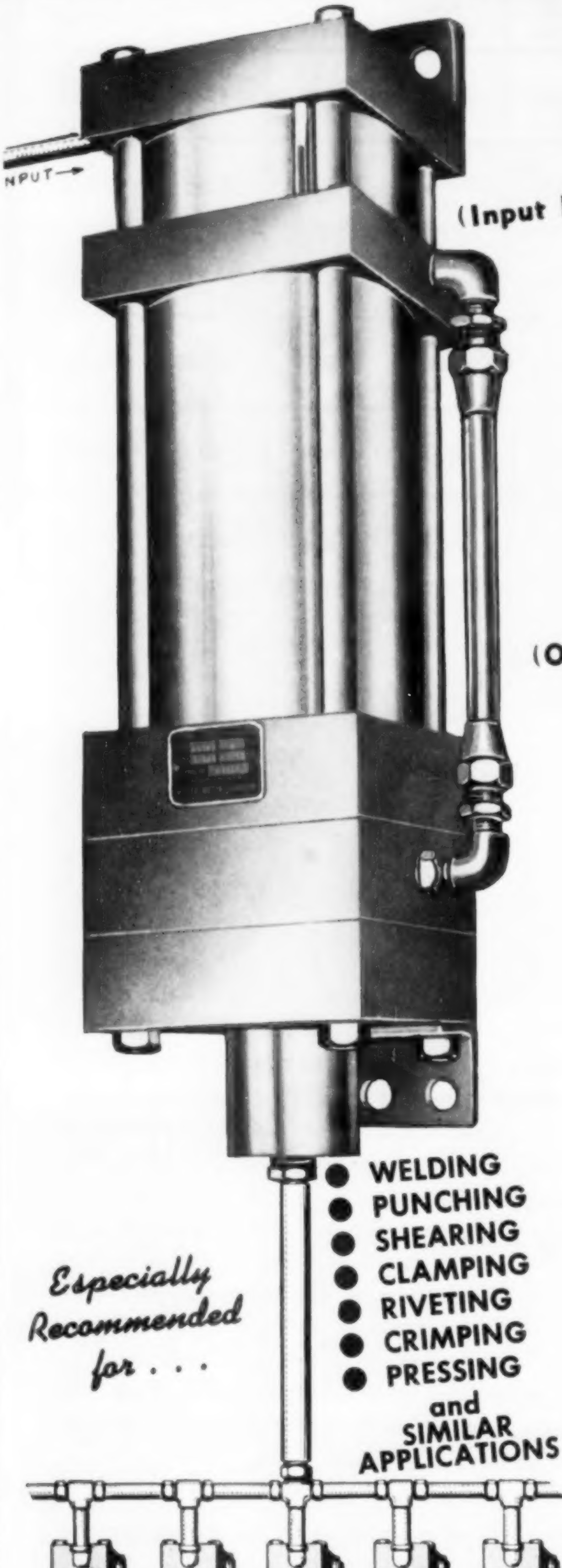

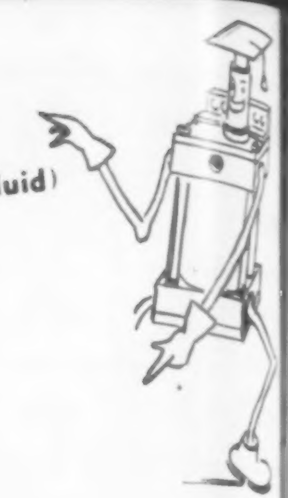

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(Output Range: 200 to 10,000 psi Fluid)

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Used in place of air cylinders, the booster driven hydraulic work cylin which can do the work of an air cylinder ten times as large and heavy, space and weight at point of application of cylinder thrust—since the boo itself can be mounted separately—away from the hydraulic work cylin and either on or off the equipment or machine.

In many installations, the popular Miller Dual Pressure "Air Miser" Boo *saves up to 95% of the air* normally consumed by direct-driven air cylin

A wide selection of sizes, pressure ratios and mounting styles are avai for the first time at low cost on a normal delivery schedule because M Boosters are built up from stock Miller standard cylinder parts to elim costly designs, patterns and castings.

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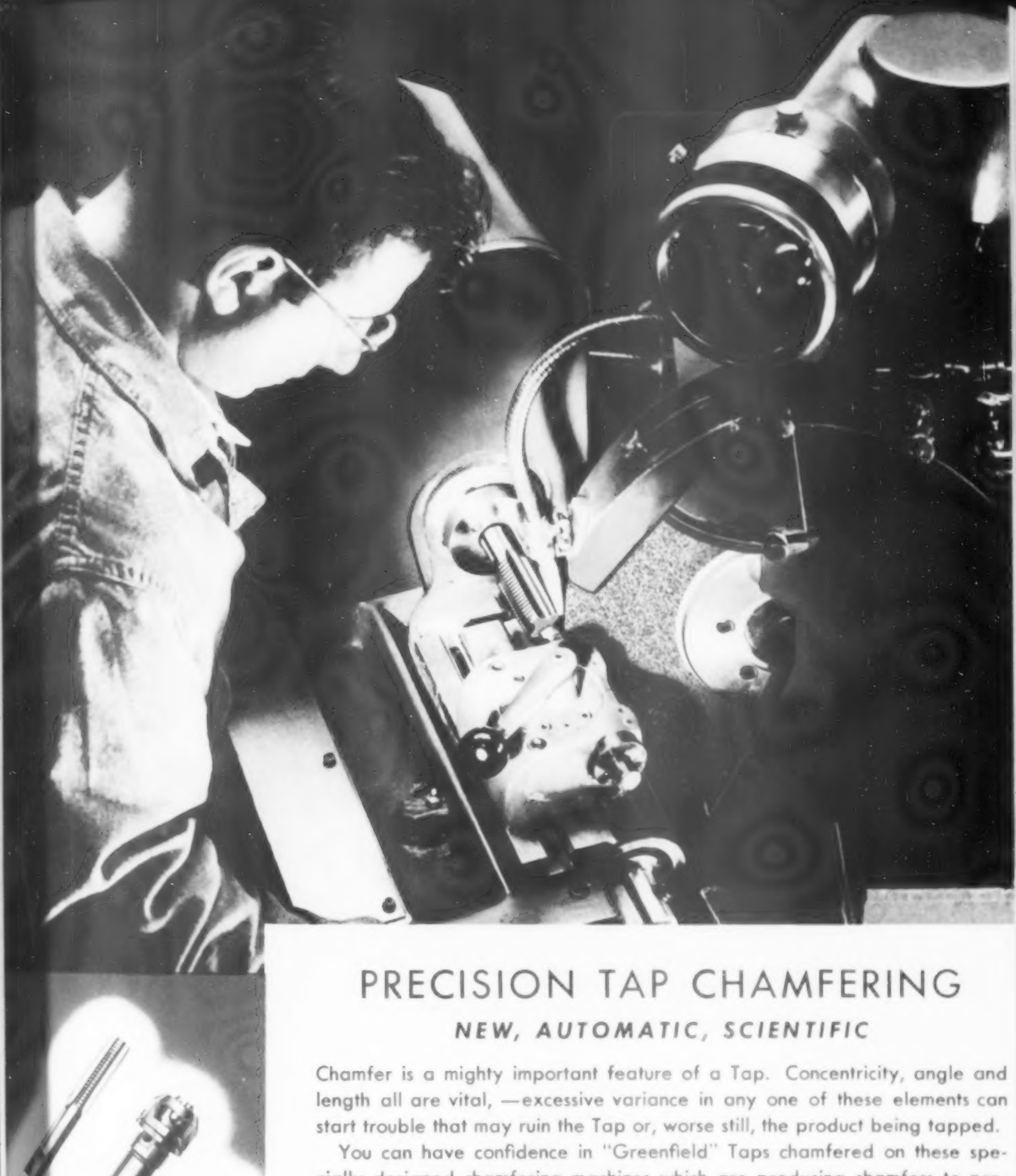


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FOR LIVE SPINDLE MACHINES
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General Purpose
Heavy Duty Head
in 7 sizes,
threads 1/16" to 2½"
KDS
Five Chaser Type
for square, flat and
irregularly shaped stock
2 sizes, threads 1/8" to 1"
KT
For conventional or
reverse taper pipe threading
3 styles, 3 sizes,
threads 1/8" to 1" pipe
CK
For light duty
fine pitch threading
5 sizes, threads
7/16" to 3¼"
Simple, compact, rugged, positive in action, these rotary die heads are built for a life time of trouble free operation.
They are indeed fitting companions to the world famed "D" line of GEOMETRIC stationary die heads.
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WILSON CARBON
COMPANY, INCORPORATED

660 East 42nd Street New York 17, New York

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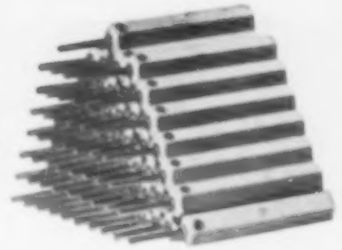
THE *Van Keuren* CARBOLOY WIRE TYPE PLUG GAGES



One VAN KEUREN CARBOLOY GAGE = Fifty TOOL STEEL GAGES

Use VK Carboloy Gages for long run jobs because of the enormous saving in gage cost.

Use VK Carboloy Gages on fussy jobs because of the infinitesimal gage wear. All parts will be within the specified limits.

VK Carboloy wire type plug gages are made to Class B accuracy, plus .00005" minus .00000" on the Go unit and plus or minus .000025" on the No Go unit. Closer or wider tolerances can be supplied if desired.

Catalog and Handbook No. 34

This 208 page volume represents 2 years of research sponsored by the Van Keuren Co.
It presents for the first time in history a simple and exact method of measuring screws and worms with wires.
It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.
Copies free upon request.

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THE *Van Keuren* CO., 174 Waltham St., Watertown, Mass.
31ST YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Measuring Wires • Carboloy Plug Gages

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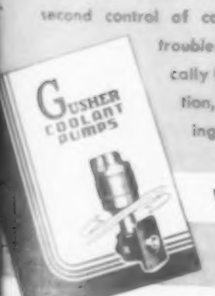
Leading the Field

RUTHMAN GUSHER
MACHINE TOOL COOLANT PUMPS

LEADERS in their field, Ruthman Gusher Coolant Pumps are: *economical*, low in initial cost, low in maintenance cost, easier to install, use less power when throttled; *efficient*, give you split-second control of coolant, require no packing and priming; *trouble-free*, are simply constructed, have dynamically balanced rotating parts for minimum vibration, and heavy-duty, pre-lubricated ball bearings for lower maintenance cost.



WRITE FOR OUR COMPLETE CATALOG

THE RUTHMAN MACHINERY CO.
1810 READING RD., CINCINNATI 2, OHIO

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EFFICIENT—LOW COST PRODUCTION
MEANS ROUSSELLE PUNCH PRESSES

O. B. I. PRESS HORN PRESS DEEP THROAT

WRITE FOR DETAILS

SERVICE MACHINE COMPANY
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TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 65.

No Postage Needed

Typical Turning Jobs On SUNDSTRAND Automatic Lathes

Save Time and Money With Multiple Tooling and Automatic Cycling

These six turning jobs illustrate the versatility of Sundstrand Automatic Lathes. Actually, it makes little or no difference whether your turning problem is a mass production job running into thousands of pieces . . . a short run of a few pieces . . . or a special turning job, our engineers can show you how to do it *better* and *faster* on Sundstrand Automatic Lathes with quick cycle changeover. *And*, you'll get all of the time-saving advantages of multiple tooling and automatic cycling on practically any turning job.

Before you buy *any* turning equipment, investigate Sundstrand Automatic Lathes.

Turning Various Electric Motor Parts

Parts include motor frames, commutator assemblies, armature assemblies, rotors, shafts etc. Operations are varied including turning of shafts, rabbet fits, and turning, facing and shaving armature assemblies. Parts are machined in both long and short runs. If you make motors, write for more detailed information.

Turning Different Types and Sizes of Pistons

These pistons range from small compressor types to large Diesel engine pistons. Materials are cast iron, steel and aluminum. Operations include turning, grooving, facing, boring, centering, milling skirt, slitting and an inspection cut after moulding. If you manufacture pistons, take advantage of the experience of our engineers . . . both on turning and milling operation.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD ILLINOIS U.S.A.

RIGIDMILS • FLUID SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

Turning and Boring 1000 Different Bushings

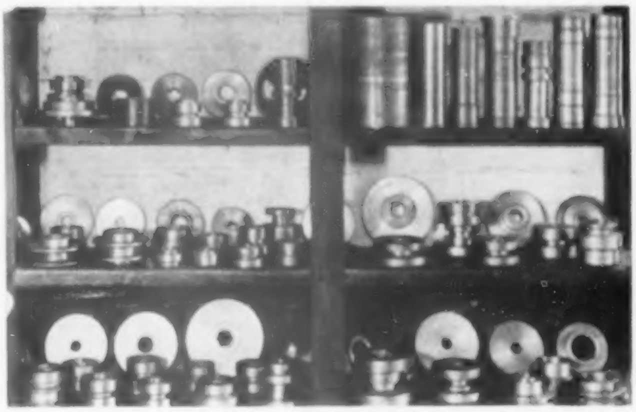
These bronze bushings come in diameters from 2⅜ to 8 inches, lengths from 2 to 10 inches. Operations include rough and finish turning the outside diameter, rough and finish boring inside diameter and facing one or both ends. *In spite of short runs (from 4 to 200) one Sundstrand replaced two other machines and doubled production.*

Turning Miscellaneous Gear Blanks

This machine manufacturer processes some 250 gear blanks of many types and sizes. Lot sizes are low yet a Sundstrand Automatic Lathe reduced turning time 40% over the former method. Machine used is equipped with overhead tool slide to facilitate wide range of tooling set-ups and to improve production.

Saving 13 Hours On Turning Each Lot of 20 Impellers

Parts are bronze, range in size fron 4" to 10" in diameter. Parts were formerly machined in three operations and three set-ups in 15 hours. Same amount of machining is done in *two set-ups* on Sundstrand in 2 hours. Turning convex and concave shapes and boring center hole comprise operations.

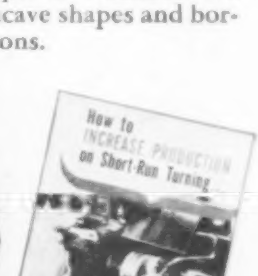


Turning Various Parts In Short Runs

This manufacturer uses 2 Sundstrand Automatic Lathes to turn parts represented by master samples shown above. Lot sizes vary from 30 to 200 and savings are tremendous. The complete story is included in the book offered at left. Write for your copy.

FREE
Additional Data

on many jobs similar to those described above are included in this helpful book. Write for your copy today. Ask for book No.797



SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS U.S.A.

SUNDSTRAND
MACHINE TOOL COMPANY

2540 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

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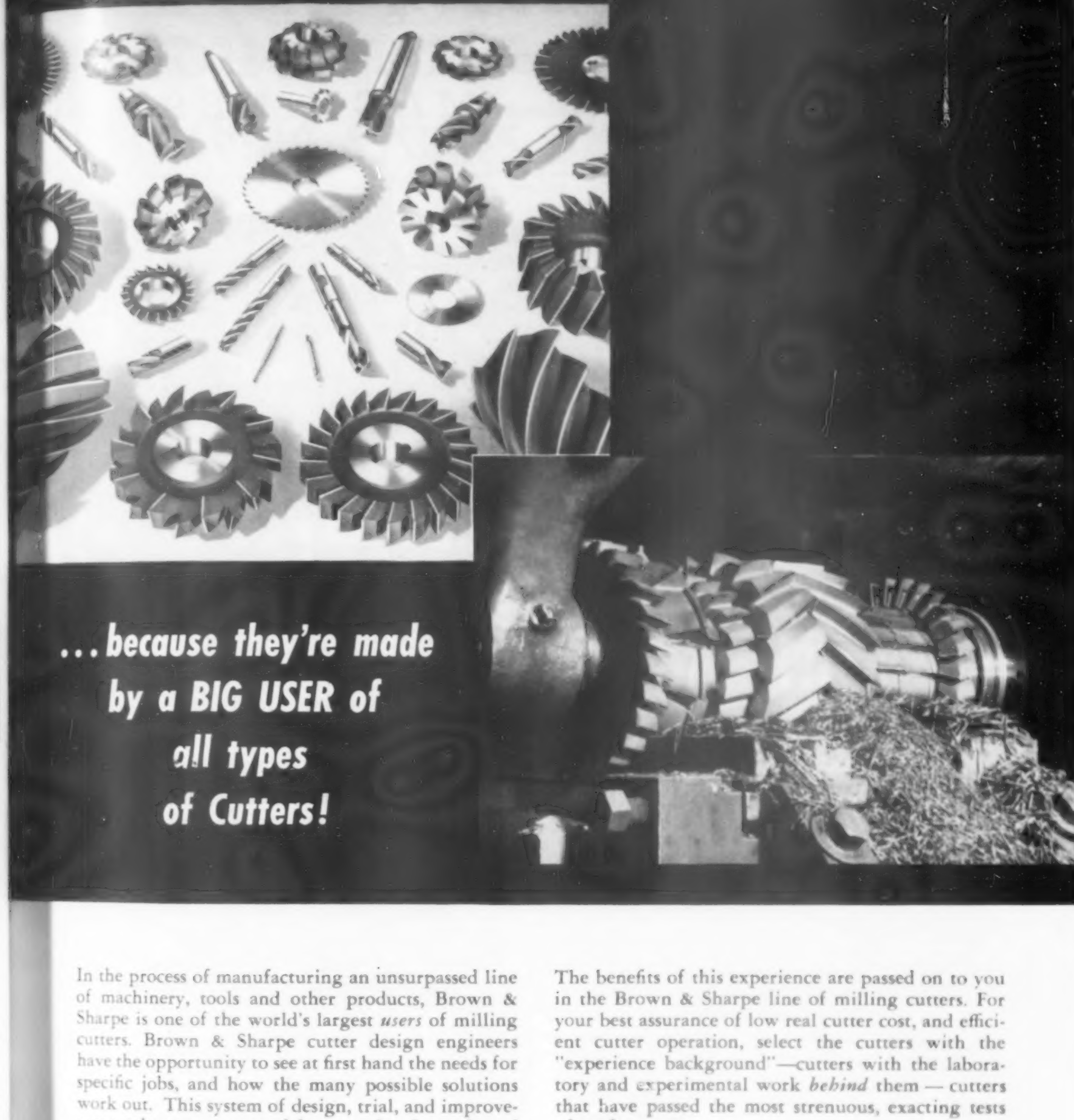


In the process of manufacturing an unsurpassed line of machinery, tools and other products, Brown & Sharpe is one of the world's largest *users* of milling cutters. Brown & Sharpe cutter design engineers have the opportunity to see at first hand the needs for specific jobs, and how the many possible solutions work out. This system of design, trial, and improvement tolerates no second best results. In each and every cutter application, Brown & Sharpe manufacture demands the best, and Brown & Sharpe experience is able to produce it.

The benefits of this experience are passed on to you in the Brown & Sharpe line of milling cutters. For your best assurance of low real cutter cost, and efficient cutter operation, select the cutters with the "experience background"—cutters with the laboratory and experimental work *behind* them — cutters that have passed the most strenuous, exacting tests of performance.

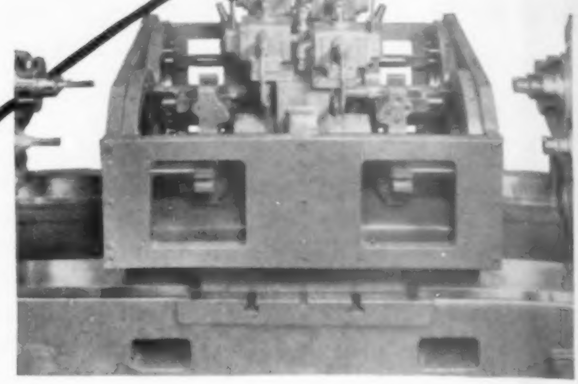
Ask for Brown & Sharpe cutters at your industrial supply distributor's. Or write for catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

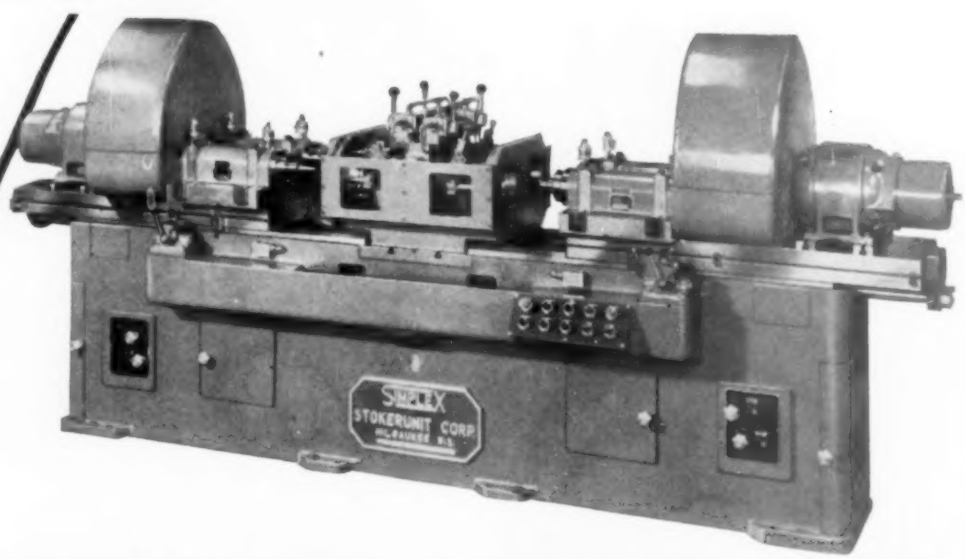
A COMPLETE LINE OF MILLING CUTTERS

PLAIN MILLING CUTTERS • HELICAL PLAIN MILLING CUTTERS • SIDE MILLING CUTTERS • STAGGERED TOOTH SIDE MILLING CUTTERS • INSERTED TOOTH CUTTERS • END MILLS • ANGULAR CUTTERS • CONVEX AND CONCAVE CUTTERS METAL SLITTING SAWS • SCREW SLOTTING CUTTERS • SPROCKET WHEEL CUTTERS • GEAR CUTTERS

We urge buying through the Distributor

BROWN & SHARPE CUTTERS





...at WESTERN ELECTRIC
Telephone Exchange Parts Precision Broached on Oilgear Machines

■ Oilgear Broaching Machines have been used by the Western Electric Company plants for many years ... in some cases as far back as 1928. This great telephone and communications equipment manufacturer uses Oilgear Horizontal and Vertical Broaching Machines for finishing many delicate precision parts that go into telephone exchange assemblies.

In the scene above, three Oilgear single slide vertical surface broaching machines are used to finish various types of magnetic core pins. The first two machines finish broach two flats and a groove on 4 pins per cycle. Production on each machine is in excess of 1600 pieces per hour. The third machine broaches on each pass four 23/32" flats which have been butt-welded to round pole pieces. Production is better than 400 pieces per hour.

Oilgear Broaching Machines have many features which are available only on Oilgear Machines *at no extra cost*. Here are some of these features. Oilgear two-way rever flow variable delivery pumps have an efficiency of 90 at full load. You get higher, independently adjustab cutting and return speeds, and positive broaching spe up to 150% overload. The patented electro-hydrau control is integral with the pump and eliminates valv and piping. Power is *saved* because power is *used* on in proportion to the load ... because power is reclaim on return stroke ... because there are no valves to was power. The Oilgear system is a simple system. It us less piping, is accessible yet compact. Wider slides an tables on Oilgear Machines allow broaching of 2 or mo parts per cycle. Oilgear also has longer tool slides, an longer ways. Pre-loaded work tables offer closer broachi tolerances and smooth, harmonic operation. For furthe information, write: THE OILGEAR COMPANY, 1573 W Pierce St., Milwaukee 4, Wisconsin.

Oilgear PIONEERS IN FLUID POWER

BROACHING MACHINES AND PRESSES

why

PHOTO—COURTESY MORRISON-DRABNER STEEL

the man who shears for a living uses Cincinnati Shears!

He gets a quick and satisfactory return on investment — many a Cincinnati Shear has totally paid for itself in less than a year.

Cincinnati Shears produce accurate blanks without costly dies or special setups — cut production costs to the bone. They satisfy a critical trade and promote business.

The machine tool like accuracy, the rapid gauging, the ability to shear quickly and satisfactorily make the Cincinnati All-Steel Shear a profitable machine in any shop.

Write for Catalog S-5, illustrating Cincinnati All-Steel Shears.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

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Index of The Tool Engineer Advertisers

JULY, 1950

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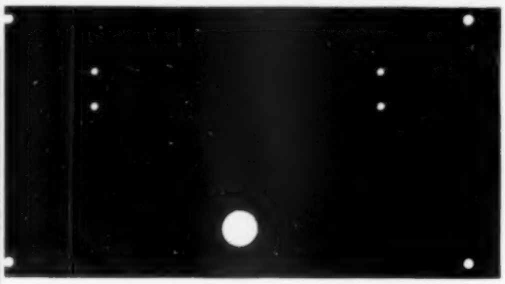
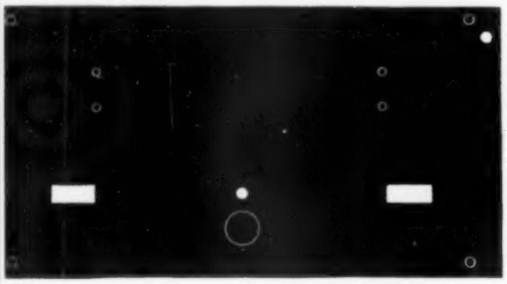
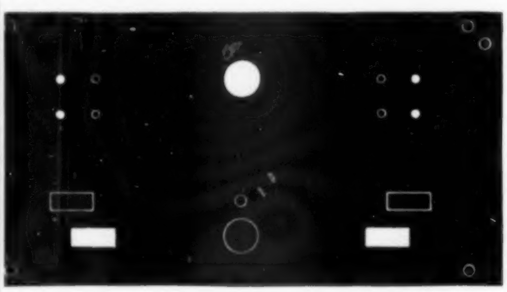


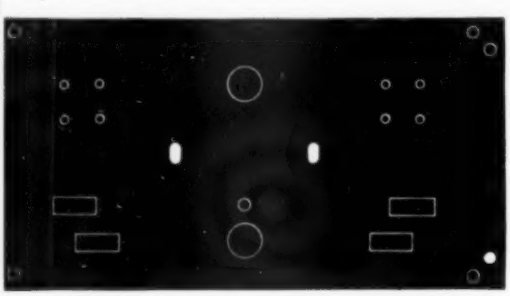
Setting up 3 Work Stops and 9 Wales Hole Punching Units for above operation required only 9.6 minutes. See combined set-up and running time for 50 pieces below.



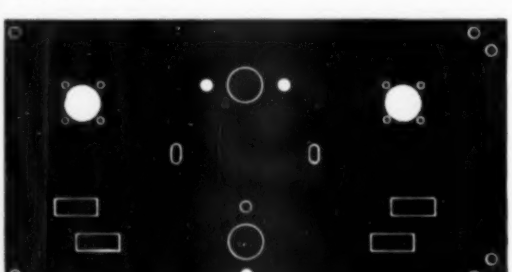
Setting up 2 Pick-up Stops and 5 Wales Hole Punching Units for above operation required only 6 minutes.



Setting up 2 Pick-up Stops and 7 Wales Hole Punching Units for above operation required only 7.6 minutes.



Setting up 2 Pick-up Stops and 4 Wales Hole Punching Units for above operation required only 5.2 minutes.



Setting up 2 Pick-up Stops and 5 Wales Hole Punching Units for above operation required only 6 minutes.

ERFORATING TIME AVERAGES APPROXIMATELY .2 INUTES PER OPERATION, THE TOTAL RUNNING TIME OR 50 PIECES IS (.2 x 50 x 5 OPERATIONS) 50 MINUTES.

IE COMBINED SETUP AND RUNNING TIME OF THE 50

COMPAR

WALES

TIME STUDIES

WITH YOUR PRESENT METHOD

● If your present methods of hole punching do n produce similar parts including set-up time as fast the total time of the typical part shown at the left yo are letting dollars fly out your window.

The patented design features of Wales Type "B Hole Punching Units provide *cost savings* that you ca not afford to overlook. For example, only 16 Wal Type "BL" Hole Punching Units were required punch the 30 holes in the work shown at left.

Write for fully-illustrated Bulletin 7 TODAY a have all the cost-saving facts at your finger tips.

WALES-STRIPPIT CORPORATION

GEORGE F. WALES, *Chairman*

393 PAYNE AVENUE, NORTH TONAWANDA, N.Y.

(Between Buffalo and Niagara Falls)

WALES-STRIPPIT OF CANADA, LTD., HAMILTON, ONTARIO

Specialists in Punching and Notching Equipment

Showing a typical set-up of a series of operations of Wales Hole Punching Units with finished work in foreground.